News of the Industry Begins Page 348

AUTOMOTIVE INDUSTRIES

LAND AIR WATER

Volume 68
Number 11

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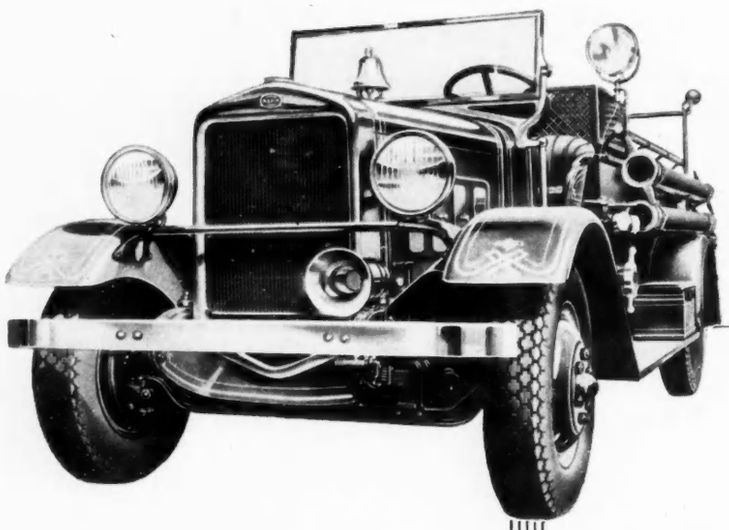
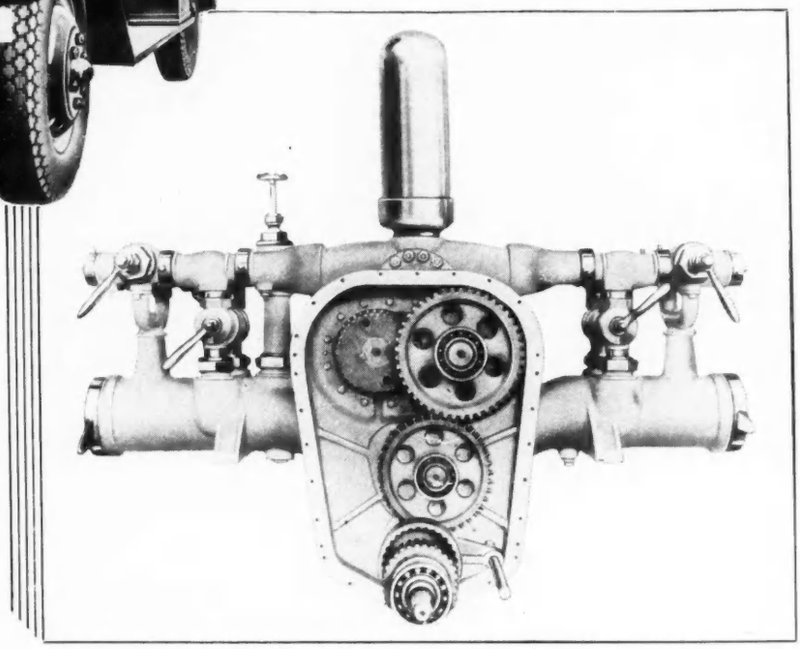


● *Maxim fire truck and pump (below) showing gears and shafts of Nickel Alloy Steel. Mfd. by Maxim Motor Co., Middleboro, Mass.*



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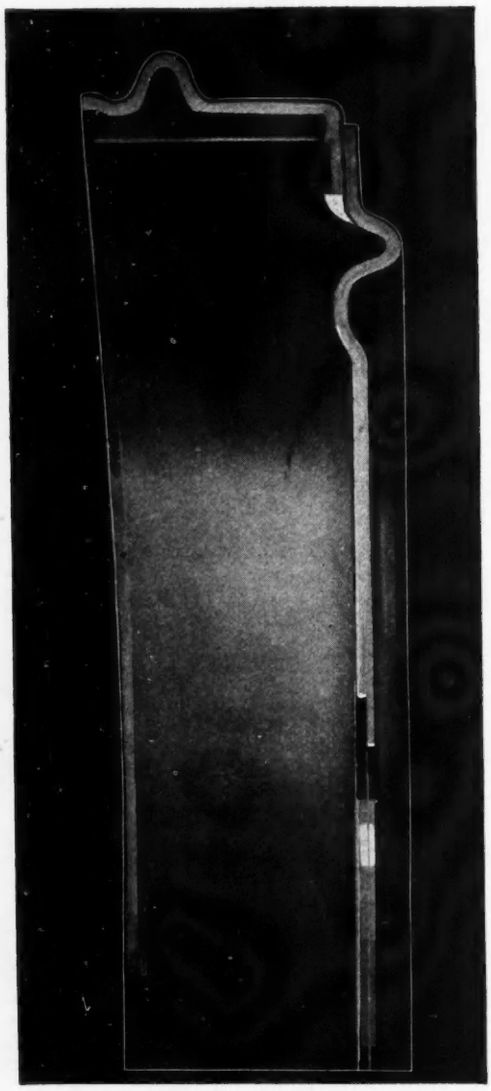

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AUTOMOTIVE INDUSTRIES
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Volume 68 Number 11

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Cable Address ..... Autoland, Philadelphia
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OFFICES

New York—U. P. C. Bldg., 239 W. 39th St., Phone Pennsylvania 6-0080
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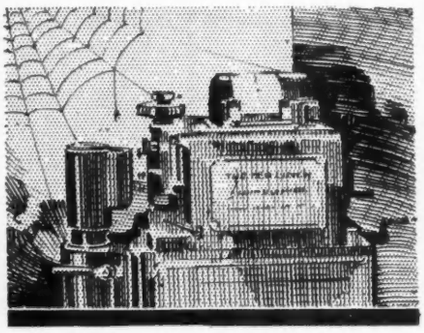

2 The Gear Department Foreman, however, was not completely sold on the practical value of every-day use of Red Liner—and simply placed the machine in a dark corner until he should get around to using it. Let's be charitable and say he meant to try it out, but never got around to it. . . . The fact is that the RED LINER lay idle and neglected until they began to have serious gear troubles, which they could not rectify.

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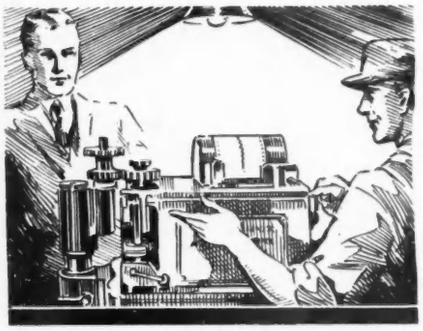

3 They called in a Gear Shaper Service man. His FIRST step was to uncover the Red Liner, turn on the light—and put it to work locating the trouble. It didn't take long, either, to discover the trouble, or open Mr. Gear Shop Foreman's eyes. He saw the intense practical value of the machine, how it could be used regularly to help him cut better gears. Since then you couldn't GET the Red Liner away from him.

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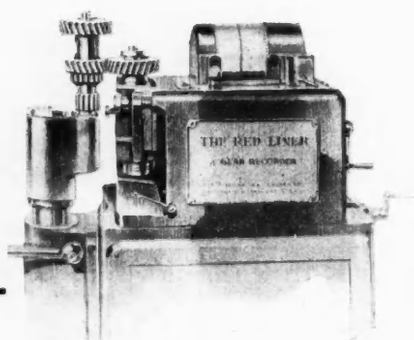

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AUTOMOTIVE INDUSTRIES

Vol. 68, No. 11 • THIRTY-FIFTH YEAR • March 18, 1933

PRODUCTION COMEBACK HINGES ON NEW DEAL'S EFFECTS

Reports of Improved Sentiment Following Reopening of Banks Gives Confidence that Early Resumption of Pre-Holiday Trend Will Be Possible

by Don Blanchard
Editor, Automotive Industries

WITH the reopening of the nation's sound banks, the automotive industry is gradually shaking off the creeping paralysis which has been spreading its grip steadily during the last month and which brought production to a virtual halt during the national bank holiday. Obviously restoration of operations to the pre-holiday level hinges on the rapidity with which the public comes back into the market. Consequently, until a fuller opportunity has been had to gage the public's reaction to the emergency program, any forecast of production during the next few weeks would be guesswork. Under the circumstances, March production obviously will be nothing to cheer about.

During these trying days, the industry can do much to help itself over the rough spots in the road left by the banking earthquake, by continuing to display the spirit of cooperation and mutual helpfulness for which it is famous. More than ordinary forbearance, intelligent liberality, sympathetic understanding, confidence and courage, are essential during the recovery period. Those who continue to exercise these virtues during these difficult times, will do much to cement their trade relationships and to hasten a return to normalcy. In fact, seldom have automotive executives had an equal opportunity to build good-will and thus to turn adversity into ultimate profit. Selfish individualism will serve only to prolong the crisis. A spirit of cooperation will shorten it. It is as important now for business men to have confidence in each other as it is for them to have confidence in banks.

Despite the fact that the banking upheaval came right at the start of the best automotive selling season, there still is confidence in the industry that much or all of the ground lost in the last few weeks will be regained later in the year. The steps taken by the President to ease the banking situation and to balance the budget, have been well received by the industry, and there is considerable expectation that they will be the forerunners of a new faith.

This attitude toward the future is strengthened by early reports from important centers following the reopening of the banks, which indicate

A NATION-WIDE renewal of confidence appears to have been the effect of the progressive re-opening the country's banks during the week. Early reports from widely scattered points indicate a stimulation of buying interest. Other evidences of restored faith are the strength exhibited by commodity and security prices; an increase of more than $300,000,000 in national gold reserves; the international strength of the dollar; the uptrend in bond prices, particularly those bearing the name of the United States; and the continued excess of bank deposits over withdrawals.

Business isn't going to get entirely well all at once, but the public's reaction to the "new deal" so far indicates that it thinks that a start has been made toward laying the foundations for a new prosperity. Not the least important reason for a better feeling is the passage of the President's Economy Bill by Congress.

a vast improvement in sentiment over the pre-holiday low. Moreover the recent sustained strength in the commodity market is regarded as another omen of returning confidence. These encouraging developments plus the fact that, as B. C. Forbes put it, "You can't fall out of a subcellar," gives some justification for believing that things are not going to be as bad as they may look now, despite the dislocations which the banking holiday created. Certainly if the new deal in banking brings a real and early return of confidence, final production figures will show that the present hiatus was well worth its tremendous cost.

Of course, if the currency expansion permitted under the emergency law, has an inflationary effect, the industry stands to reap an immediate benefit from the public desire to convert currency into things which have a value in use. In fact, some executives feel that recent reports of renewed buying interest are evidence that the desire to convert cash into goods already is effective. While this reported renewal of buying interest may be due to inflationary fears, it seems more probable that it is due to normal economic factors. Whether the ultimate effects of an inflationary era might be expected to be so desirable, is a question for which the inflationists have one answer and the hard money zealots another.

Aside from the question of whether the effect of the new currency will or will not be inflationary, the emergency plan to restore confidence in banks is meeting with widespread approval although some amendments may be made in it in the interests of state banks. Failure of some banks to pass the soundness test established as a prerequisite to opening, will entail some hardship among their depositors. But several years of temporizing with the situation in the apparently vain hope that something would happen to put over-extended banks on their feet, had gotten us nowhere. In the long run, therefore, it will probably prove to be to the best interests of the people as a whole, to clean the situation up and get the uncertainty over with.

The emergency act, incidentally, does not make the paper of instalment finance companies eligible for rediscount by the Federal Reserve except under extraordinary conditions. If a bank has exhausted all of its eligible assets, in an emergency, the new law permits the Federal Reserve to rediscount ordinarily ineligible paper. Although this privilege may mean much in the case of individual banks, it is doubtful that generally speaking it will be of much importance as it is unlikely that normally eligible paper will prove insufficient to meet the public's demands for the new currency.

The new administration has emphasized, however, that inflation is not its intention and that, despite the suspension of gold payments, the new currency is based on sound assets so that in purchasing power, it should maintain its parity with gold. Inasmuch as a substantial share of the new issue might be backed by U. S. bonds which are only as good as the credit of the government, if the effect of the new currency program is not to be inflationary, the importance of maintaining the government credit is self-evident. That the President is determined to maintain the national credit is indicated by his first budget message calling for cuts in 1933-1934 expenditures approximating $500,000,000. This message probably has done more to quiet fears of inflation than anything else that might have been done. In addition, the fact that the Federal Reserve has wide discretionary powers which it may be expected to use wisely, tends to inspire confidence in the new money. Still another factor in favor of continued "sound" money is the governmental effort to make its gold reserve as large as possible.

It is quite possible that no great use will be made of the new emergency currency. The fact that most of the 40 billions of loans and investments of the nation's banks can be converted into cash, may be all the assurance depositors need that they can get their money when they want it. This assurance combined with the government's declaration that "an open bank is a sound bank," may well turn out to restore confidence sufficiently to start money flowing back into the banks. In that case, continued use of the currency expansion provision of the emergency law would be unnecessary as there is more than enough currency now to take care of the normal requirements of business if it is allowed to circulate.

JUST AMONG OURSELVES

Factory Boost for Service

HAVING followed the changing attitude of factory executives toward dealer service problems, we always take special interest in specific statements on the subject. Most recent one to impress comes from W. H. Beal, Auburn's dynamic young president, who told a dealer group recently that their service departments, "properly operated, should very largely cover the overhead of doing business."

"Your service department," he added, "should be your best salesman. Satisfied owners are the equivalent of cash in the bank for you—and your service department plays a great part in keeping owners satisfied." Not revolutionary words, to be sure, but sound ones.

Tax Wolves See the Light

THE policy of socking the motorist for taxes at last is beginning to reach the point of diminishing returns. The depression has helped hasten arrival at this point, but many states were approaching it rapidly anyhow. High taxes on vehicles and gasoline have now driven enough cars from the road to cause a falling off in total revenue from these taxes sufficiently large, apparently, to register with state legislators.

This is indicated, at least, by the fact that well-backed proposals for reduction of passenger car registration fees have appeared in Arkansas, Connecticut, Delaware, Georgia, Indiana, Kansas, Maryland, Nebraska, North Carolina, Ohio, South Dakota and Texas.

Declining revenues undoubtedly will stop the rush to overtax motor vehicles more quickly than all the arguments about justice.

Consignment Talk Revived

NO business in the country has hung on to a cash basis more vigorously than has the automotive business through this period of money stringency. Manufacturers in general have continued to demand cash on delivery from dealers, although finance companies in some cases have floor-planned cars 100 per cent for retailers when the factory in question accepted the finance company's promise as credit.

Some dealers have accepted checks, but, as compared with retailers in many other lines of business, cash was very widely demanded.

The whole situation is returning to normal as we write, but it will be a long time before the entire country is back on an even keel from a financial and banking standpoint. It is to be expected that cash will be tight in many areas and with many people for some time to come. It will be interesting to see if anything in the nature of consignment of cars or shipments to dealers on open account is forced in any considerable number of instances before the emergency is over.

As one executive pointed out to us last week, it isn't such a long jump from present practice to consignment as some might think. "Consider," he said, "the case of a finance company controlled by a car manufacturer. The finance companies today commonly floor-plan cars for dealers 90 per cent, only 10 per cent coming from the dealer in cash. How much of a jump is there from that to consignment?"

Well, as another executive replied, "Not much in practice—but a big jump in principle."

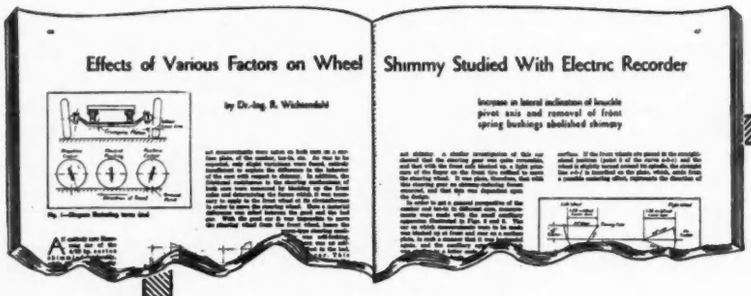
Production Trend Reversed

PRODUCTION'S normal trend has been reversed this year. We are witnessing the unusual picture of a February and probably a March with totals lower than January. What's more, March is likely to run behind even the low February figures. Gloomy as that reversal seems, the reasons for it are so patently temporary as to be almost encouraging in their dejectedness.

January actually went ahead of January, 1932, thus marking the first month to be ahead of the similar month of the previous year for a long while. Then came February and March with their bank closings and hopes went glimmering again.

But at least one of the most analytical economic observers of our acquaintance says that fundamentally the change had come, not in January, but even before; and that his figures prove it. He believes, moreover, that the jagged upward course of business will be resumed quickly and will proceed gradually as the banks are reopened.

There may still be hope for some reasonable amount of automobile business before the end of 1933. We can't quite agree with the seasoned executive who greeted our query about the outlook on March 1 with the reply: "The automobile business is gone for this year." It may be, but this is no time to admit it!—N.G.S.


Effects of Various Factors on Wheel Shimmy Studied With Electric Recorder

by Dr.-Ing. R. Wichtendahl

Increase in lateral inclination of knuckle pivot axis and removal of front spring bushings abolished shimmy

In this important series of articles, Dr. Wichtendahl dissects the experimental data reported in his former articles which appeared in Automotive Industries of Oct. 1, 1932. If you have a steering problem, this series may help you solve it.

by
Dr. Ing. R.
Wichtendahl

Part
One

WHAT MAKES

IN the article "Effects of Various Factors on Wheel Shimmy Studied," in *Automotive Industries* of October 1, 1932, I reported on test runs with a Hanomag and NAG-Protos car in which the motions of the front axle and the front wheels were traced by means of an electric recording instrument. The curves obtained showed plainly that shimmy can be eliminated by certain expedients.

In the following I will attempt to explain the reasons for the test results given in the article mentioned, and in doing so—as far as this is possible in a short article—refer to previous publications on the same subject, specially emphasizing views expressed and experiences recorded there, as in contrast to or in confirmation of the conclusions arrived at by me, in the hope of serving the general cause. Since all publications concerning shimmy are based on special cases, but never the same case, it is obvious that a measure which eliminates or minimizes shimmy in a particular case, may fail in many or all other cases.

It was not my problem to investigate shimmy scientifically, but rather to find as quickly as possible a cure for a particular case. Before one approaches a task of this sort it is natural to first study the literature of the subject, and try to take advantage of the knowledge gained and recommendations made. But there is a very voluminous literature on shimmy and it is impossible to read everything. In addition to a number of shorter articles I studied particularly the extensive treatments by Kauffmann (1927), Wedemeyer (1930) and Becker, Fromm and Maruhn (1931).

According to the opinions of these investigators, shimmy is influenced by the following factors:

1. Knuckle-pin inclination
2. Caster
3. Elasticity of the steering linkage
4. Steering geometry
5. Wheel lever arm
6. Play in the steering mechanism
7. Frictional resistance in the mechanism and at the track
8. Frame distortion
9. Tire pressure
10. Chassis springs (supplementary transverse springs)
11. Dampers
12. Imperfect balance of vehicle wheels
13. Gyroscopic moments of vehicle wheels
14. Gyroscopic moment due to angular motion of vehicle
15. Oscillation of front axle

While Kauffmann does not discuss the gyroscopic moment of the front wheels at all and assigns the principal influence on shimmy to the axle setting, recommending a negative caster of 1 to 2 deg. and unequal steering radii as the most effective cure, Wedemeyer as well as Becker, Fromm and Maruhn hold entirely different views.

Wedemeyer suggests as preventives the choice of

different springs, different tires, a different weight distribution, a change in the knuckle-spindle inclination and the fitting of dampers. He, however, considers these only as expedients to shift the critical shimmy speeds of existing vehicles so as to carry them outside the range of usual driving speeds. If shimmy is to be completely eliminated it is necessary to choose a new front-axle design which prevents the development of gyroscopic forces; that is, a so-called oscillating axle design.

Becker, Fromm and Maruhn, who in their book "Schwingungen in Automobillenkungen" (Vibration in Automobile Steering Gears) investigated most of the factors enumerated above thoroughly on the test stand, nevertheless finally come to the conclusion that "the means employed for the prevention of dangerous oscillations in trapeze steering linkages of motor vehicles are inadequate. They are effective only under particularly favorable conditions, which cannot be maintained in the practical operation of vehicles, or other imperfections have to be taken in the bargain." They, too, are of the opinion that shimmy is dominated by the gyroscopic action of the front wheels and can be eliminated only if it should be found possible to eliminate the gyroscopic action or to compensate for it. On the basis of this finding they developed their new "cross steering system."

Quite interesting are the different views and results of measurements regarding the effects of the axle setting. Kauffmann, for instance, found with the Horch steering gear, and also with a Mercedes car on the test stand, as well as with rather primitive equipment in road tests, that with positive caster up to 8.5 deg. the shimmy oscillations are very large, but that in the region of ½ deg. negative caster they disappear entirely. Wedemeyer, on the basis of mathematical considerations, arrives at the conclusion that shimmy will disappear as soon as the inclination of the knuckle spindle exceeds 7.5 deg. Unfortunately, it is not stated in this connection whether 7.5 deg. of positive or negative caster, or both, is meant. Such a large caster would be impractical from the driving standpoint. Becker, Fromm and Maruhn, at a speed of 34 m.p.h., at which the unbalance of the wheels has no influence on the system, made the same observation as Kauffmann, that with about 2 deg. negative caster shimmy disappeared suddenly. On the other hand, caster had little influence at the higher speeds where the unbalance of the front wheels created resonance in the oscillating system.

In the case which I had to investigate, I at first had two new 4/20 hp. Hanomag cars at my disposal, of which one was substantially free from shimmy while the other shimmied perceptibly. It was my first task to discover the differences between the two cars which would explain their dissimilar behavior.

The thought naturally occurred that in the car which shimmied, the front wheels might not be perfectly balanced, but an investigation showed that this was not the case. An interchange of the wheels of the "good" and the "bad" car resulted in no improvement. The shimmy characteristics of the "bad" car were such that it shimmied only on poor roads, but at all speeds, the amplitudes of the oscillations increasing with the speed. On good roads, on the other hand, the car behaved properly at all speeds. Even on the chassis dynamometer, on which the front wheels could be rotated at much higher speeds than on the road, it was impossible to observe either shimmy or tramp. It is important to call special attention to these shimmy characteristics, since the cases dealt with by other writers showed different characteristics.

Kauffmann investigated three types of steering mechanisms, including one Horch steering gear with which there was violent shimmy at between 11 and 13.5 m.p.h. By changing the car speed materially the shimmy could be eliminated. In the Buick car the shimmy occurred at between 12 and 20 m.p.h., in the Mercedes investigated at between 12.5 and 15.5 m.p.h. To start shimmy, a shock to one of the road wheels was always required.

Every Hanomag car, before it leaves the moving chain on which it is assembled, passes through a chassis dynamometer (or roller test stand). A few of the cars will shimmy and tramp strongly on this test stand in the highest speed range. In every such case investigated the cause of the vibration was found to be imperfect balance of the road wheels, and replacement by specially balanced wheels always removed the trouble.

As it was definitely proven that unbalance of the front wheels was not the cause of shimmy in the case to be investigated, both cars were accurately measured statically, but, as was to be expected, all measurements were substantially equal. A comparison of the two cars with respect to the frictional resistances in the steering gears finally brought the explanation for the difference in their behavior. With the front axle blocked up, it was impossible, in the case of the "good" car, to move the steering wheel from the road wheel, whereas in the case of the "bad" car it was possible to move the entire steering mechanism up to the steering wheel, by the application of a certain force; that is to say, in the "good" car the steering gear was irreversible or self-locking, in the "bad" one it was not.

'EM SHIMMY?

An analysis in two parts of shimmy phenomena observed during extensive road tests in Germany

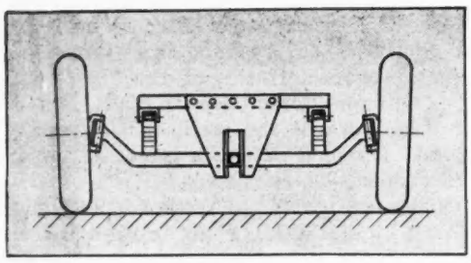


Figure 1

Making the steering gear self-locking therefore would have constituted a simple solution of the shimmy problem, as in the Hanomag car all parts of the steering mechanism are sufficiently strong to obviate trouble from elastic forces therein, but it is obvious that rendering the steering gear self locking is not an elimination of the phenomenon of shimmy, but merely an elimination of its effects, particularly those on the steering wheel. A strong stop spring installed in the steering linkage of the "good" car broke after a short interval, which goes to show that in the "good" car, also, strong shimmy forces were present, but on account of the self-locking feature they could not produce the usual effects.

Unfortunately, in the literature of the subject with which I am acquainted, the surface conditions of the steering gears is in no case mentioned. Kauffmann in a special investigation determined the force which was necessary to produce certain deflections of the road wheels with the steering wheel fixed (which corresponds to self-locking of the steering gear). He found that about 1100 lb. was required at a radius of 3 in. to produce a 4 deg. deflection of the road wheel. My observations of many cars of different types is that the steering gear is not self-locking as a rule.

In this connection I wish to point out that in my estimation, if the steering gear is not self-locking or the steering wheel is not held absolutely rigid by the driver, the steering linkage does not represent an elastic system, since there is no fulcrum or fixed point.

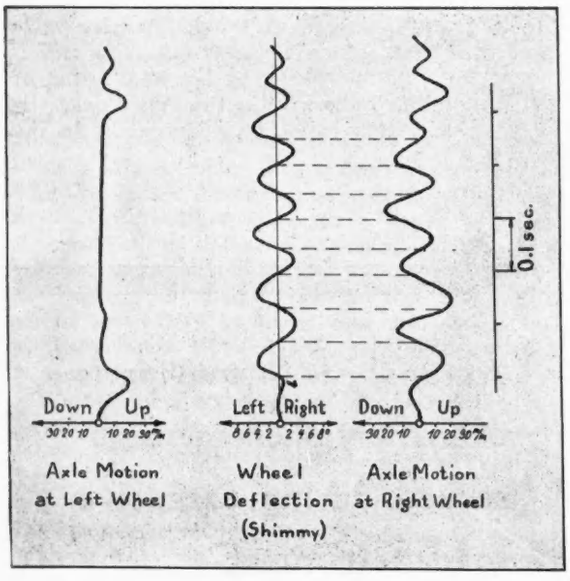


Figure 2

I would make an exception of the tie rod in case the left and right wheels receive shocks in opposite directions. The provision of a cushion spring in the drag link is of little importance in this connection, since a shock coming from the front wheel is directly transmitted to the steering wheel without compressing the cushion spring beyond its precompression point.

Of all the cars investigated by me, the NAG-Protos car (31000 miles service) had the least friction in the steering gear. With the front axle blocked up, only a light finger pressure on the tire was necessary to move the entire steering mechanism. This car, however, was practically free from shimmy even on the worst roads. It may be pointed out here that the car had considerable backlash in all joints of the steering linkage. This will be specially referred to later.

Between the "good" and "bad" Hanomag car and the NAG-Protos car there is therefore unquestionably a strong difference. The results obtained from the latter conclusively show that it is possible to assure shimmyless operation with the conventional design of front axle and that certain design features bring about this condition. It was now my further task to determine what these features were.

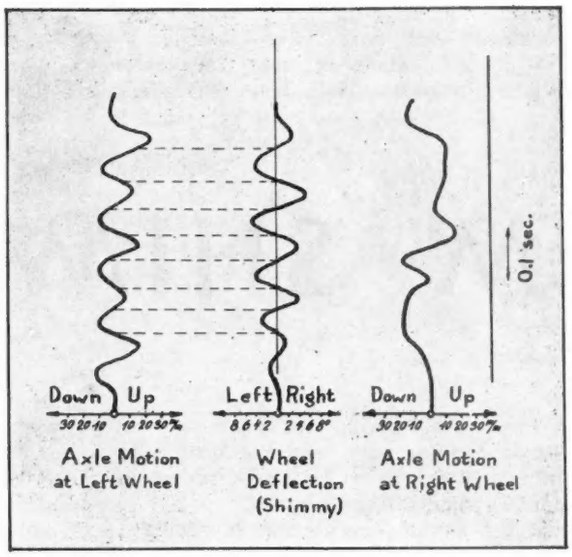


Figure 3

To begin with, I followed the recommendations of the investigators quoted in the foregoing, as far as this could be done with simple means. That is, changes were made in the caster, the wheel lever arm, the inflation pressure, etc., but without success. In order to disturb the "main circuit of the linkage," described in the book by Becker, Fromm and Maruhn, lateral motion of the axle relative to the frame was made impossible by providing a guide of the type illustrated in Fig. 1. But runs with this construction and with several degrees of caster showed no improvement.

In order now to be able closely to observe the motions and the effects of different changes during runs on poor roads, the test runs with the electric vibration recorder were undertaken. The vibration records, which were published in *Automotive Industries* of October 1, 1932, indicate a direct relationship between the vertical tramping motion of the front axle produced by the poor road surface, and the horizontal

shimmy motion of the front wheels. Fig. 2 represents a small section of a front-end-vibration record. The left wheel in this case passed over a smooth section of road, while the right wheel passed through pot holes. Between the axle motion at the right wheel and the magnitude of the shimmy motion there is now this relationship:

Axle motion at right wheel upward corresponds to wheel deflection toward the left. Axle motion at right wheel downward corresponds to wheel deflection toward the right.

Fig. 3 shows a section of another vibration record in which the left wheel particularly passed through deep pot holes. Here the relationship is as follows:

Axle motion at left wheel upward corresponds to wheel deflection to right.

Axle motion at left wheel downward, corresponds to wheel deflection toward left.

The relationships just discussed justify the conclusion that gyroscopic forces are at play. If a gyroscope turns with an angular velocity ω in radius around an axis A-A', which latter is to be turned around the axis B-B' with an angular velocity $d\varphi/dt$, the moment necessary to effect this latter rotation is

$$Md = Pa = J_w \, (d\varphi/dt)$$

where

P is the force in pounds

a, the lever arm in in.

J, the polar moment of inertia in lb-in.-sec^2

ω, the angular velocity with which the gyroscope turns around A-A', in radius per sec.

$d\varphi/dt$, the angular velocity with which the gyroscope turns around the axis B-B', in radius per sec.

If now the gyroscope is turned around the axis B-B' with a moment P_a, it develops the same moment around the axis C-C'. The direction of this moment depends upon the directions of the two rotations of the gyroscope. In Fig. 4 the directions of motion have been drawn in for the case when the right-hand wheel receives an upward shock through a pothole. In this case the right wheel makes a deflection toward the left. The left wheel evidently also is subject to the deflection to the left by the gyroscopic action, as the direction of motion is always the same for both wheels. Consequently, the following relations exist:

Wheel deflection to left if:

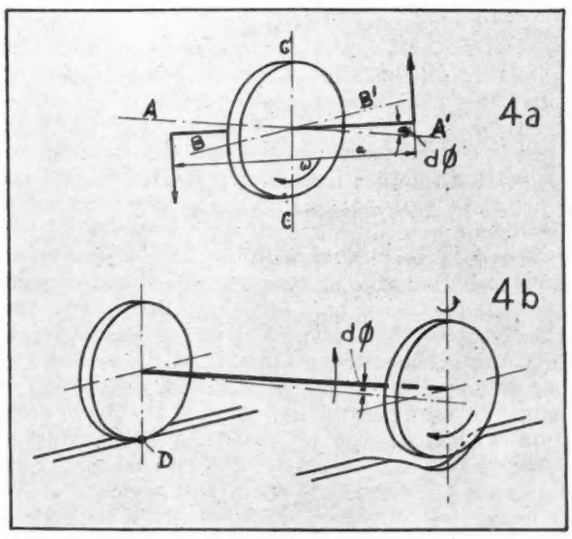


Figure 4

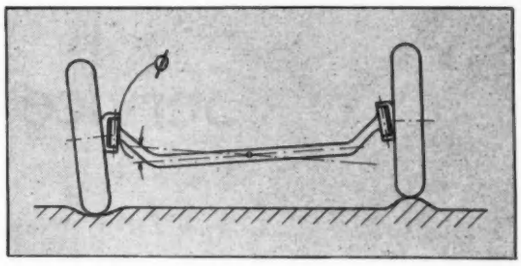


Figure 5

Axle motion at right wheel is upward

Axle motion at left wheel is downward

Wheel deflection to right if:

Axle motion at right wheel is downward

Axle motion at left wheel is upward

I wish to point out here specifically that a wheel deflection occurs only when the axle motion is accompanied by a wheel rotation in the plane B-B'. With the conventional type of front axle this wheel rotation is associated with the axle motion, as in the case described, according to Fig. 4b, the whole system must turn around the point of ground contact D of the left wheel.

The results of the test runs according to Figs. 2 and 3 show clearly that the actual wheel deflections agree with the deflections expected from gyroscopic action. Even though this is not a direct proof, it is quite certain that shimmy in this particular case is a result of gyroscopic effects.

In order to deal effectively with this form of vibration, it is first of all of considerable importance to determine the order of magnitude of the gyroscopic moments in play.

The polar moment of inertia was determined by the pendulum test from the equation

$$J = 4.21 \left(\frac{G_o}{n^2} - \frac{G}{g} \right) e^2$$

where G is the weight of the wheel in lb.

e, the distance of the point of suspension of the pendulum from the center of the wheel, in in.

n, single swings per minute

g, acceleration of gravity.

For the Hanomag front wheel it was found that J = 5.64 lb-in-sec.^{2}, for the front wheel of the NAG-Protos, 19.7 lb-in-sec.^{2} The angular velocity ω at 30 m.p.h. is 40 radians per sec. in the case of the Hanomag and 33 in the case of the NAG-Protos.

Whereas J and ω can be accurately determined, the last factor of the equation, $d\varphi/dt$, is largely dependent on the momentary condition of the road surface. From the vibration records it is found that the time of a single vibration is always about 1/20 second. The angle of deflection φ described during this time varies a great deal. In the most unfavorable case one wheel would be in a pothole and the other on top of an obstacle (Fig. 5), and during the next moment the axle would occupy the reverse position. With the largest axle motion measured (2 in.) and a tread of 48 in. the maximum angular motion is easily found by a simple geometrical operation to be $\varphi = 5$ deg. For this extreme case the factor $d\varphi/dt$ would have a value

$$\frac{5}{1/20} \times \frac{1}{57.3} = 1.75 \text{ radians per sec.}$$

(Turn to page 343, please)

Service Needs Foreshadow Wider

Engineers Study Motor Lubrication in Joint Symposium of the S. A. E. and A. S. T. M.

WHEN about 400 people go to the trouble of attending a technical meeting these days, it may be assumed that they thought the program looked pretty good. And, judging by the wholehearted participation in discussion and general comments in the lobby, this huge outpouring of petroleum technologists and practical operating engineers placed its stamp of approval upon the symposium on motor lubricants which was held in New York on March 8 under the auspices of the American Society for Testing Materials and the Society of Automotive Engineers.

The dinner, which acted as a refreshing interlude between the long afternoon session and the evening session, was enlivened by Dr. Dickinson's talk on the essentials for recovery.

The first paper to be read at the afternoon session was "Carbon Deposits in Gasoline Engines" by W. A. Gruse. He started by enumerating the following eight factors which are of importance and govern formation of coke deposits in gasoline engines.

1. Engine running conditions, temperature, speed and load.
2. Oil consumption
3. Time since cleaning
4. Amount of dust in air
5. Air-fuel mixture ratio
6. Engine design and condition
7. Characteristics of fuel
8. Charcateristics of oil

Under No. 1, he brought out the points that carbon deposits are diminished when operating under high temperature conditions or the equivalent effect of heavy load. Under No. 5 he pointed out that there is a tendency for a deposit to increase with rich mixtures.

Less Viscous Oils Would Help

In general, the author reaches the following conclusion:

"It is indicated that if an engine without an air-cleaner runs cool on a rich air-fuel mixture with a high oil consumption, the oil being one of high carbon residue value, the engine will very probably encounter a great deal of trouble traceable to carbon deposits. The opposite conditions, dust-free air, a hot-running engine with a lean air-fuel mixture, and low consumption of an oil of low carbon residue value, will very probably induce freedom from excessive deposits. Obviously, the cars on the road present all the permutations of all the shades of interval of all these conditions. As regards the lubricating oil itself, this study suggests the disirability of hastening the day when the average motor can use, with tolerably low consumption, oils of much lower viscosity than the present S.A.E. Nos. 40 and 50 grades." The adoption of such less viscous lubricants is probably the simplest means of remedying some of the troubles and securing some of the advantages discussed above."

In the discussion of this paper, T. S. Rogers of the Standard Oil Company of Indiana said that careful tests in their laboratories indicate that carbon deposits may also be controlled by low temperature. Their tests show a sensible drop in carbon deposits at very low temperatures, that is low compared with ordinary running conditions. He also intimated that the customary coking test does not have much practical significance since it does not reproduce service conditions in the engine. His organization does approve of volatility as a fundamental test in studying the tendency to form carbon deposits.

Pumpability of Oils

In the absence of the authors, "Present Concepts of the Relation of A.S.T.M. Pour Test to Service Requirements of Oils," by J. L. McCloud and "Viscosity of Automobile Crankcase Oils as Related to Service Requirements" by E. W. Upham, were grouped together for discussion and were read by A. C. Mougey.

In the first paper, J. L. McCloud concludes that the A.S.T.M. pour test is one of suitability and that in any general type of oils, it or some related test must be used in consideration of the service requirements of oils for internal combustion engines. Tests made at the Ford Motor Co. confirm the published data and lead to the conclusion that cold tests are necessary to indicate the suitability of oils under definite conditions. It is therefore suggested that the A.S.T.M. pour test is not one to measure quality, necessarily, except as related to other tests under service conditions. The author of this paper includes a curve showing the results of pumpability tests on various kinds of oils. The data is plotted with Saybolt viscosity as ordinates and discharge as abscissa, and the statement is made that the Texas base oils pump better than the Mid-Continent or Pennsylvania dewaxed oils of equal viscosity. In commenting on this, C. M. Larson of the Sinclair Refining Co. suggests that this data may be misleading to the operator and showed the same data replotted with discharge as ordinates and temperature, deg. Fahr., as abscissa. He claims that this gives a truer picture of the conditions which are obtained in service. Larson's data are given in Fig. 1.

In the second paper, E. W. Upham, Chief Metallurgist of the Chrysler Corp., set the three following requirements of a lubricating oil for automobile engines.

Use of Lighter Engine Oils

1. Viscosity limitations must be such as to insure starting of the engine in cold weather.

2. Viscosity limitations must be such as to prevent excessive oil consumption.

3. Viscosity limitations must be such as to secure fluid film lubrication.

"Considering the other two requirements," Mr. Upham said, "as far as I know, no results of tests have ever shown that limitations of viscosity required to meet No. 3 would not be met within the ranges prestatement here that no crankcase oil is made at present that will meet the requirements of both Nos. 1 and 2. In other words, an oil that will satisfy our requirements for cold weather starting will not satisfy our consumption requirements, and vice versa. Until automobile engines are changed, or a far different lubricant can be produced from any we have at present, we will have to use one range for cold weather based on starting requirements, and another range for warm weather based largely on consumption requirements."

Mr. Upham said that it is generally accepted that under temperature conditions of zero deg. Fahr. an oil as purchased with a maximum Saybolt viscosity of 50,000 seconds at that temperature, is desirable for starting with the average engine. He feels that with the trend toward closer tolerances and tighter machine fits, we can look to a lowering of this limiting viscosity value. Experimental work by the author and other laboratories points to the conclusion that it is the viscosity of oil on the cylinder wall that lowers the engine revolutions per minute under cold weather starting conditions. The oil at the bearings has very little effect.

Perhaps the most important statement made by Mr. Upham is the fact that in his opinion the trend in the development of lubrication specifications is toward the greater consideration of service requirements. Physical properties limit are being questioned on the basis of what is needed for service, not what is obtainable in laboratory.

A. E. Becker of the Standard Oil Co. of N. J. in discussing both papers agreed that both viscosity and pour test are required in determining the suitability of the lubricant. For low temperature conditions the viscosity at the starting temperature is most important, in particular, viscosity at the temperature prevailing on cylinder walls.

J. C. Geniesse of the Atlantic Refining made a plea for a narrower range of operating temperatures in the crankcase. For instance, a lubricant is expected to have quick starting characteristics at low temperature, yet have good lubricating qualities when running at high temperatures. At the present time the spread between starting and operating temperatures is too wide and the desired viscosity index is not commercially available. Mr. Geniesse stressed the need for larger batteries and better starting equipment since battery output depreciates with lower temperatures and, consequently, provides insufficient power under the very conditions where the maximum power is needed. One of the operating engineers amplified upon this point by mentioning the fact that there is an increasing use of higher voltage batteries which seem to solve the problem of better starting from cold.

It was admitted by a number of the discussers that the use of lubricating oils of lower viscosity was de-

(Turn to page 359, please)

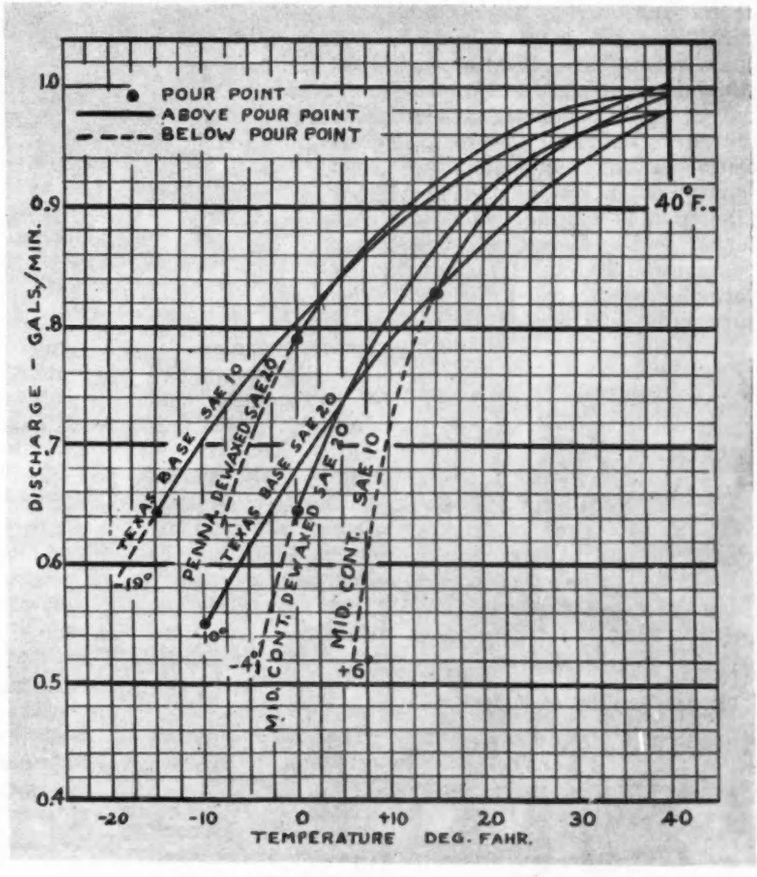
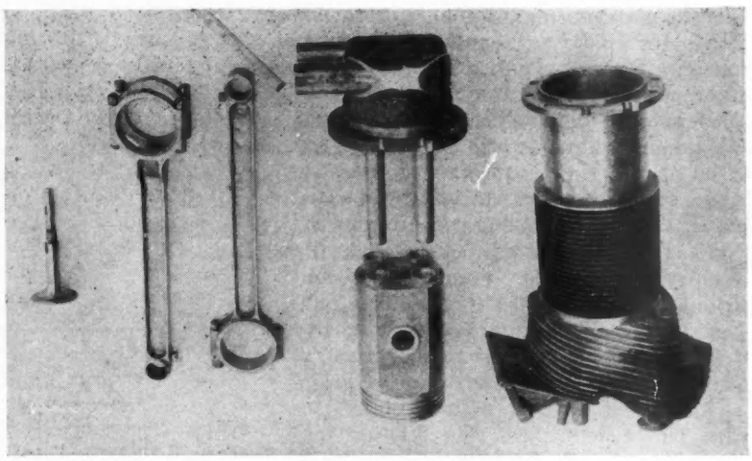


Chart presented by C. M. Larsen to show effect of temperature on pumpability for different oils

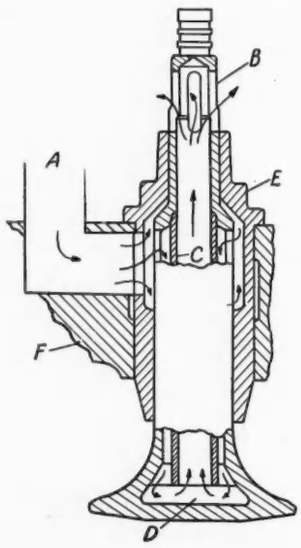
Liberty 12 Revamped for Tank Service Has

AIR-COOLED CYLINDERS VALVES and PISTONS



Cylinder, piston and connecting rods of the converted Liberty engine

THE Heat-Controlled Motor Company of Minneapolis, Minn., has developed a system of engine cooling whereby the interior parts of the engine subjected to the highest temperatures—the pistons and the exhaust valves—are cooled by forced air circulation through them, while the cylinders and heads are cooled by the conventional blower system. The effectiveness of the system has been demonstrated on a twelve-cylinder Liberty tank engine which was converted to the Heat-Controlled Motor Company's system. This engine is normally water cooled, but difficulties have been experienced in cooling it properly, which is undoubtedly accounted for by the fact that in a tank it is not possible to place the radiator in an exposed position. If the large engines required by modern tanks can be effectively air cooled it will certainly be considered an improvement by those who have to handle them.



Cross section through exhaust valve and guide, showing cooling-air passages

The Liberty tank engine is a twelve-cylinder, 45-deg. V engine of 5 in. bore and 7 in. stroke, and the compression ratio used in this air-cooled conversion model is 6 to 1. Below the cylinders no change was made in the construction of the engine, while practically all of the more important parts above the crankcase were replaced by new ones. The cylinder head and barrel are finned on the outside in accordance with conventional practice. Internal cooling of the pistons is effected as follows:

Fastened to the crankcase below the cylinder and projecting up into the piston are four tubes, two on each side of the connecting rod. Each pair of tubes on the same side of the connecting rod is connected to a larger tube which projects through the side of the crankcase, and one of the two larger tubes connects to the blower housing. The piston, which is an aluminum casting, is formed with an interior cooling jacket. This jacket extends up the skirt on one side, covers the whole under side of the piston head, and then extends down the skirt on the other side of the connecting rod, thus leaving an opening from the piston bosses down for the connecting rod to swing in. At the bottom of the piston on each side of the connecting rod there are two bosses, which are drilled

to take the tubes that extend up from the crankcase, which thus enter the cooling jacket. The tubes make a sliding fit with the piston, which is maintained throughout the stroke. Air from a blower is delivered through a distributing manifold to one of the two tubes projecting through the crankcase wall, whence it passes through the two tubes on one side of the connecting rod into one leg of the cooling jacket, then across underneath the piston head, down the other leg of the jacket, and out through the two tubes on that side.

The under side of the piston head is finned parallel to the direction of air flow. An air-and-oil seal between the four tubes and the piston is effected by means of rings that function in the same way as piston rings. This seal keeps oil out of the air passages and prevents the cooling air from getting into the crankcase. Cylinders and connecting rods had to be lengthened on account of the greater length of the piston.

The exhaust valve has a hollow stem of comparatively large diameter, and a tube extends up through its center to within ¼ in. of its head. The chamber within the valve stem has four ports which register with the counterbored section of the valve guide, the latter being connected to what is known as the air-to-valve manifold. The tube inside the valve stem is provided with four ports where the stem emerges from the valve guide, and the heated air is discharged through these ports into the atmosphere. Air for cooling the valves is taken from the blower housing through pipes to a distributing manifold, from which there are leads to the individual valves. The air is led to the counterbore in the valve stem, down the stem across the head of the valve, into the tube, and out the exhaust ports just beyond the valve guide Standard inlet valves are used.

Under ordinary conditions all of the air would be taken from a single blower, but in this experimental engine air for external cooling is supplied by a large blower in front, and air for internal cooling by a small, belt-driven blower in the rear. It is averred that for aircraft engines no blowers would be required.

Cylinder heads are cast of British "Y" alloy and are screwed onto the barrels with a slight shrink fit. Barrels are of chrome-molybdenum steel. Each cylinder head has a total radiating surface of 1027 sq. in., which is equal to 7.45 sq. in. per cu. in. of displacement, and to 31.8 sq. in. per b.hp. The maximum temperature occurs at a point between the valves, and in the experimental Liberty engine it was measured by means of a thermo-couple ⅛ in. above the valve seats.

The cylinder barrel is turned from a forging. The fins are turned on 5/16 in. centers and are ⅝ in. deep. Each cylinder barrel has a total radiating area of 567 sq. in. or 4.12 sq. in. per cu. in. of piston displacement. The piston head has a radiating area of 59.78 sq. in.

The exhaust valve head has a radiating area of 2.72 sq. in. on the inside. The inside of the stem has a radiating area of 7.08 sq. in., giving the exhaust valve a total inside radiating area of 9.8 sq. in.

Cooling air is supplied by a 22-in. centrifugal blower encased in the conventional scroll-shaped housing. It has 48 forwardly curved blades and at 1600 r.p.m. will deliver 4900 cu. ft. of air per minute against a static head of 4¾ in. of water.

Temperature of Combustion-Chamber Wall Between Valves, Deg. Fahr.

Cylinder No.	1	2	3	4	5	6
Right bank	468	470	456	451	443	462
Left bank	470	475	440	450	450	445

Top of Cylinder Barrel (Exhaust Side) Deg. Fahr.

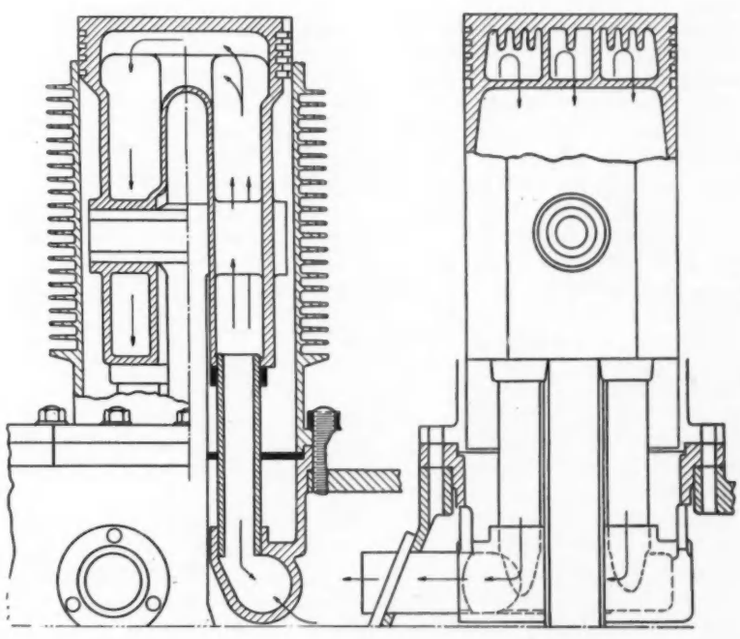
Right bank	400	410	395	590	380	390
Left bank	410	391	380	365	370	375

In the dynamometer test the small blower (for internal cooling) delivered 600 cu. ft. of air per minute against a static head of 12 in. of water at 1600 r.p.m. engine speed, or 3200 r.p.m. blower speed.

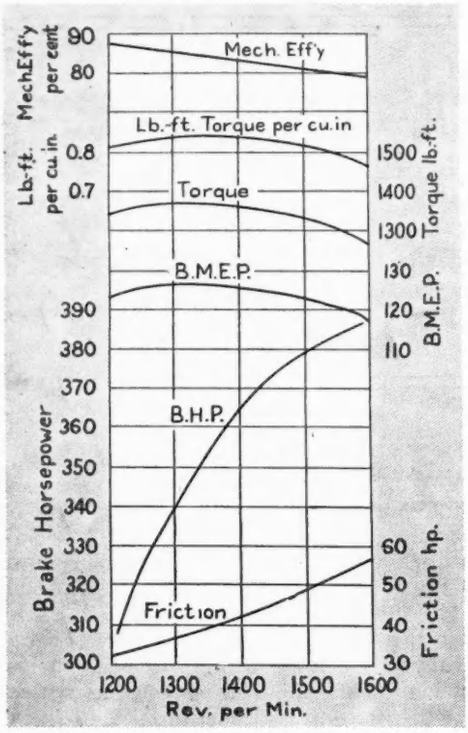
When the air for both internal and external cooling is supplied from one blower a high-pressure chamber is constructed inside the blower housing which supplies the air for the internal cooling.

After the engine has been assembled it was subjected to block tests, and maximum b.hp. were determined for the speed range 1200-1600 r.p.m. At 1400 r.p.m., the normal speed of the water-cooled Liberty engine when installed in a Mark VIII tank, this engine develops 338 hp. The power curves show that at this speed the converted engine developed 394 hp. without the fans and 364 hp. with the fans. At 1600 r.p.m. the converted engine developed 432 hp. without the fans and 387 hp. with them.

Little trouble was experienced in obtaining uniform cylinder temperatures once the carburetors were prop-



Cross section through the piston



Performance curves of converted Liberty tank engine

erly balanced. A small rectangular deflector in the front of the "V" gave excellent results. Due to the fact that the fin spacing on the cylinders was so wide, it was necessary to insert small baffles between the barrels to limit the air flow. Above are temperature readings taken during a full-load run at 1500 r.p.m.

The cooling air on passing through the fins is raised in temperature by from 100 to 150 deg. Obviously it would not do to exhaust this heated air into the engine compartment, and the engine therefore was enclosed in a box-like construction which deflects the air up and leads it out through a louvered opening in the top of the tank.

The block tests showed that the engine cooled adequately on the block and that the thermal efficiency was high, on account of the high compression ratio made possible by internal air cooling. The test officers considered that the necessity of using a special brand fuel of higher octane rating (aviation high test, 87.1 octane rating) than government issue gas is a disadvantage from a military standpoint, but Test Officer George H. Rarey expressed the belief that this is not a serious disadvantage, in view of the fact that military planes will use fuel of the higher octane rating, and since the tendency in engine development is toward higher compression, on account of thermal efficiency and power possibilities, the octane rating for all engines may be increased in the near future.

After dynamometer tests were completed the engine was installed in a Mark VIII tank (44 tons) at Aberdeen Proving Grounds. It left nearly twice as much room in the engine compartment to move around in as the water-cooled engine, owing to the elimination of the water-cooling accessories.

Since there are no hills on the proving grounds it was impossible to make the engine pull full load even in high gear at top speed. A medium tank (23 tons) was therefore taken in tow, and with the transmission of this in low gear and the planetary drive in high gear, full throttle was required at 1400 r.p.m. or about 5 m.p.h., the top speed of the tank. The towing test was continued until the brake bands on the towed tank overheated.

The conclusions reached at the end of the operating test follow:

a. The internally and externally air-cooled Liberty engine functions under maximum load without developing excessively high temperatures.

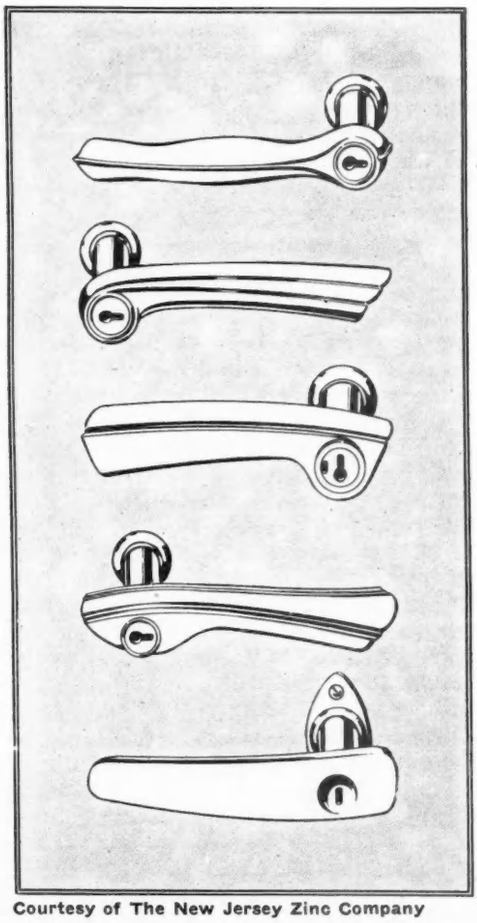
b. Further development of this engine is required before definite conclusions as to its practical value can be reached.

c. An air-cooled engine is preferable to a water-cooled engine for military service.

d. The internally and externally air-cooled Liberty engine shows promise of development into a satisfactory air-cooled engine.

The internal and external cooling system described in the foregoing was developed by V. O. Beede, chief engineer of the Heat-Controlled Motor Co.

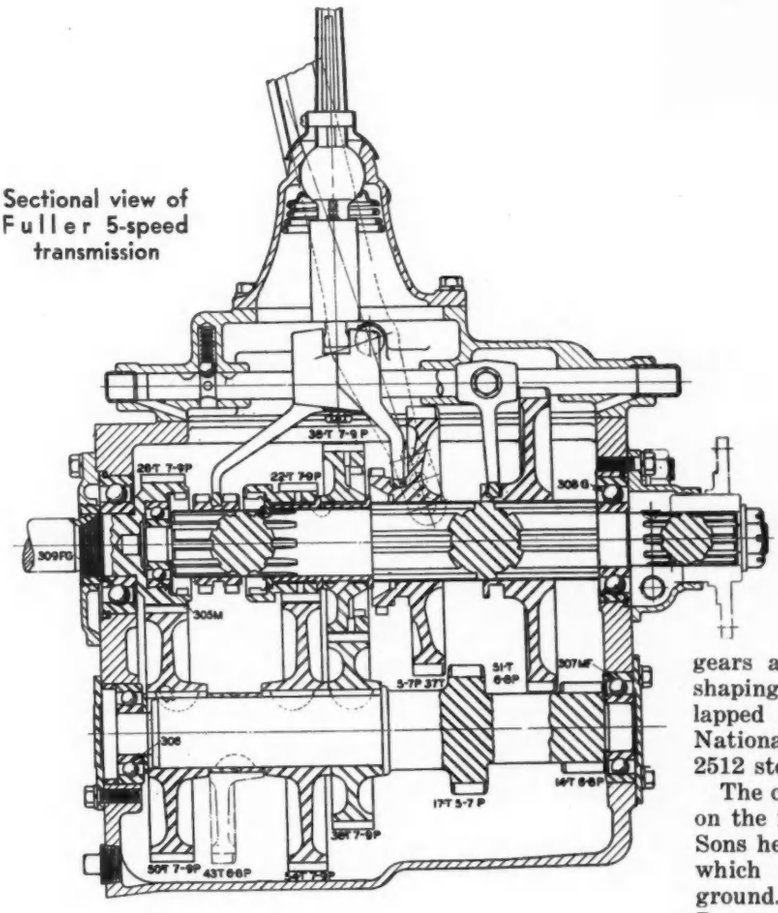
The Vogue in Automobile Door Handles



Courtesy of The New Jersey Zinc Company

An artist's conception of a few of the die-cast zinc door handles shown on various makes of cars at the New York Show. These designs were featured on the following makes reading from top to bottom: Buick, Pontiac, Hupmobile, Chevrolet, Studebaker

Third and Fourth Speeds Have Helical Gears in New Five-Speed Transmission



Sectional view of Fuller 5-speed transmission

Gear Ratios

Model	Overdrive 5A380	Underdrive 5A38
Fifth	.785	1.00
Fourth	1.00	1.42
Third	1.93	2.40
Second	4.18	4.70
First	7.00	7.90
High reverse	4.15	4.68
Low reverse	7.16	8.09

A NEW five speed transmission, with quiet constant mesh helical gears for fourth and third speed drive, in addition to countershaft drive, has recently been introduced by Fuller and Sons Mfg. Co. for truck use. The transmission is also available in an overdrive type, with direct on fourth, in which case the helical gears are effective in third speed and the overdrive fifth.

Engagement of the three quiet gear speeds (including direct) is by means of sliding tooth clutches, effective in providing an easier and shorter shift. High or low reverse, or both, are optional. The shift lever is provided with a positive latchout control, which is raised for engagement of emergency low and high reverse. Shifting positions for the four top speeds and low reverse are of the conventional four-speed transmission type.

Designed particularly for transportation work, where a large wear factor is required, the gear pressures have been reduced to approximately 60 per cent of that encountered in conventional spur gear transmissions. The helix angle is 23 deg. 25 min. Helical gears are of S.A.E. 4615 steel, case-hardened after shaping and burnishing. After hardening they are lapped on a reciprocating machine produced by the National Broach Company. Spur gears are of No. 2512 steel and also case-hardened.

The construction used for mounting the idling gears on the mainshaft is similar to that in the Fuller and Sons herringbone gear auxiliary, with steel sleeves on which the idling gears rotate, case-hardened and ground. They are a light press fit on the shaft. Bronze bushings are pressed into the gears.

S.A.E. standard power-take-off openings are provided on both sides. A separate power take-off gear is mounted on the countershaft when desired.

What Makes 'em Shimmy?

(Continued from page 337)

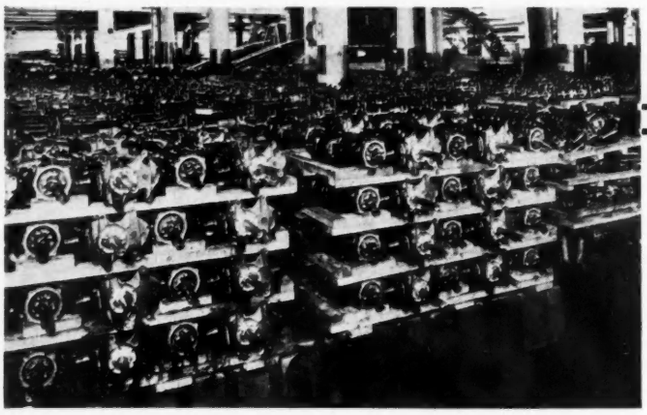
the factor 57.3 being introduced because the angle is given in degrees instead of in radians.

The maximum gyroscopic moment for the two front wheels of the Hanomag car at a speed of 30 m.p.h. therefore would be

$$2\,J\,\omega\,\frac{d\varphi}{dt} = 2 \times 5.64 \times 40 \times 1.75 = 789.6 \text{ lb.-in.}$$

With the NAG-Protos the gyroscopic moment under the same conditions works out to 2010 lb-in.

This extreme case, of course, occurs only very rarely. As a rule, the obstacle will not exist and the gyroscopic moments then will be only half as great as here calculated, but even then the forces due to gyroscopic effects will be quite important.



PRODUCTION

Foremen Profit

A group incentive plan for foremen at the Republic Steel Corp. is described in *Executive Service Bulletin,* December, 1932, by E. M. Richards. To be fair, the system relieves foremen of management conditions beyond their control. Thus no standard costs are established because these will vary with business conditions. Allowance also is made for fluctuations in the price of fuel, gas, and power. All in all, it is an honest effort to enlist and hold the cooperation of factory executives.

Revision Ready

Word comes that the new American standard for bolts heads, nuts, and wrench openings will be available in published form early in March. It bears the approval of the joint SAE-ASME committee. Copies of the pamphlet may be obtained from ASME headquarters in New York.

Machine vs Man

Space does not permit an adequate review of Dexter S. Kimball's article, "The Social Effects of Mass Production," which appeared in *Mechanical Engineering* for February, 1933. Take our word for it, it's well worth reading. It is written in the frank and open-minded manner characteristic of Dean Kimball. In concluding, the author states his belief that technological progress can not continue at an accelerated pace because of the inescapable law of diminishing returns. Nor does he feel that manufacturing concerns will tend to increase in size. In fact he is inclined to believe that the reverse will be true. Finally Dean Kimball asserts that economic freedom may be attained by peaceful means in the United States and that the problem offers a challenge to business men, engineers, economists. "Will they have the vision, courage, and intelligent statemanship to accept this challenge?" he asks.

Hinging Flush

Speaking of concealed door hinges, we ran across an interesting item in *The Automobile Engineer* (Eng.) for January, 1933. On page 40 is an illustration of an Italian body design employing a flush-type hinge. The pivots are concealed within the panel. The external leaf of the hinge swings out with the door but fits into stamped depressions in the cowl when the door is swung closed. Here is an idea well worth emulating.

Tentative Standards

Both the SAE and ASME urge interested members to study the preliminary draft of the proposed American tentative standard for jig bushings. This proposal covers dimensions and tolerances for press fit and renewable wearing bushings and liner bushings. Comments are invited from the many who use or make jig bushings. Now is the time to act!

Worth Noting

A review of mechanical engineering projects under ASA procedure is found in the February issue of *Industrial Standardization.* Manufacturers as well as individuals will find this of great interest. The time to study and suggest is before these matters become standards.

More Resin

According to the *Industrial Bulletin,* February, 1933, more and better plywood may be made by using phenolic resin as the adhesive. It is claimed that production can be stepped up since the time of bonding may be cut from the usual period of 10 to 20 hrs. to less than three minutes. At least one of the leading manufacturers in the woodworking industry thinks highly of the idea.

In the Clouds

We are greatful to *The DuPont Magazine* for February, for a little story about the adventures of Prof. Piccard and his stratosphere. An interesting feature is the fact that DuLux, the synthetic resin finish which we described some time ago, was used for finishing the sphere inside and out. Dulux White was selected for interior luminosity, exterior reflection of solar heat, and as a safeguard against the possible effusion of mercury which would attack the aluminum walls. Considering the performance of the stratosphere in all kinds of weather, and exposure to extremes of temperature, this was mighty good life of Dulux. What say?

Fertile Ground

This past season, the makers of cemented carbide tool materials have offered an untapped source of economy in metal cutting. They figure that the user can save considerable sums on his tooling if he buys unfinished tool tips, mounts them, and grinds them to suit his needs. The hitch has been that in many plants, the art of grinding has not kept pace with developments in the newer tool materials. Or perhaps there has been a lack of appreciation of the difference that exists between grinding the new and the old. Rehabilitation in this department will tap new reservoirs of economy.

LINES

Rustproofing Wins

An interesting feature of the Chrysler show exhibits was a miniature display demonstrating the effectiveness of Bonderizing as a base for fender finishes. They had two miniature fenders both of which had been given an accelerated test in a salt spray for 500 hours. One fender was Bonderized, the other was not. The latter was in bad shape with the enamel entirely gone and rust deeply seated in the metal.

Conserving Life

In the life of expensive tools such as the cemented carbides, there comes a time when some one has to decide how these tools are to be conserved. If a set-up goes full tilt until it fails or rejections appear, the tool may be damaged seriously. If a set-up is taken down at regular intervals to anticipate a dulling of the cutting edge, it may not be economical. Obviously, we need some middle course. What that may be depends upon circumstances. In the case of a large producer of brake drums where finish is the prime essential, the tooling is relieved as soon as the finish begins to depreciate. Surely an index of a similar kind may be set up on other jobs.

Wet or Dry

Looks like we're approaching a showdown in the matter of grinding cemented carbides and other hard cutting metals. The question is: shall we grind wet or dry. It's much too controversial at the moment to be settled academically. However when the experts got together at the last annual A.S.M.E. meeting at New York headquarters, many voted wet. There seems to be a growing body of opinion toward wet grinding at least where an appreciable amount of stock is to be removed.

Breaker Progress

Those interested in electrical control equipment should read "Circuit Breaker Protection for Industrial Circuits" by Lingal and Jennings of Westinghouse. This valuable paper was read at the winter convention of the A.I.E.E. It covers not only the design of modern electrical control devices but also deals with their practical application.

Non-Skids for Belting

Taking a leaf from the development of non-skid tire treads, Houghton has brought out a Vim leather belting (Vim-Tred) with a non-skid surface. The pattern is pressed into the surface of the belt. This is claimed to reduce slippage, increase the life of the belt, and increase transmission efficiency. Thereby yielding sensible economy in industrial power transmission.

Germ Veto

Bacteriological research is finding a place in cutting fluid development. One of our progressive friends in the cutting oil business tells us that he is investigating his products for "bugs." Yes, germs that may lurk or breed in the rich, juicy oils. Remember, there may be nothing to it. But if there is, he'll know quick enough. If germ-proofing is needed for added safety, it may be accomplished by the use of new antiseptics or ultra-violet ray treatment, or something.

Precision Boring

The many applications of the current Ex-Cell-O precision boring machines are described in catalog No. 3132 just off the press. Its usually practical form of presentation should make it of interest to production men.

Electrical Data

From Britain comes a handy little electrical handbook chock-full of data on fundamental units, mathematics, etc. There are sections on generators, motors, accumulators, and the like, as well as their application and wiring. It's published by the Mechanical World and Engineering Record, Manchester, Eng. Price—1'10 (whatever that is in U. S. coin) by post.

Moving Faster

Apropos of grinding cemented carbides from the rough tip. A prominent maker of grinding equipment is getting some facts for us to prove that his new machine is a bear for removing material at a fast clip. The figures will show how the right method of grinding can cut the cost of cemented carbide tools.

Cold Facts

First we heard of Dry Ice was when the hawkers on the beach started to handle ice cream bricks on the hot sands. Said bricks remained crisp and fresh despite the heat because of their dry ice packing. But recently dry ice became an industrial tool. One engine builder shrinks cylinder liners about 0.006 in. in diameter, thus permitting them to be inserted in bores of smaller diameter. This eliminates a press operation and avoids the hazard of straining the cylinder block. Another manufacturer has devised a method of assembling inserted valve seats by shrinking them in a dry ice pack. These indicate a line of thought that might be profitably followed in production and maintenance.

Did You Know That—

the total annual consumption of copper and brass in the U. S. just 100 years ago was only **500 tons?** Normal consumption of copper today is 1,000,000 tons. The romance of the copper industry, its amazing growth, its far-reaching technical development are to be featured in the Mineral Industries Building at the International Century of Progress Exposition in Chicago this year. Will you be there?—J.G.

MANUFACTURING MANAGEMENT METALLURGY

Stromberg "Fast Idle"

The accompanying sketch shows the automatic choke and idling control of the new Stromberg downdraft carburetor, with its parts in the positions they occupy during the warming-up period of the engine. Choke-valve *K* is partly closed, giving the proper, enriched mixture. Fast idle adjustment screw *J* is riding on the ear of the fast-idle stop weight *A*, which

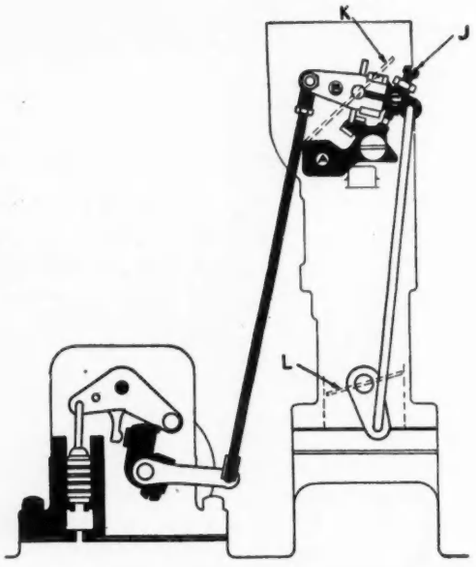


Diagram of the new Bendix Stromberg fast-idling mechanism for carburetors

prevents the throttle valve *L* from closing completely. When the engine reaches the normal operating temperature the choke valve *K* is fully opened and the ear on stop-weight *A* is moved out of the way of the stop screw so that the throttle can be moved into the regular idling position.

Wright Cyclone F Lowest in Weight

THE new Wright Cyclone F engine was granted Approved Type Certificate No. 89 by the Department of Commerce Sept. 6. This nine-cylinder engine, rated at 670 hp. by its manufacturer, was given a rating of 700 hp. at 1900 r.p.m. by the Department of Commerce.

This engine is also the lightest production air-cooled aviation engine in the world in weight-per-horsepower, weighing 1.22 lb. per hp.

New features incorporated in the new Cyclone F engine include a very short, rigid crankshaft designed to eliminate vibration at operating crankshaft speeds, and an entirely new design of cylinder head in which is included a spark plug cooler cast as an integral part of the head, which affords much more efficient cooling, thereby making it possible to obtain higher power outputs.

This new Cyclone is also equipped with a large 11-in. supercharger blower, compared to a 7-in. blower used in previous models. This will afford efficient supercharging without running the blower at high speeds ranging from 20,000 to 28,000 revolutions per minute, as has been the case with supercharged engines using small blowers.

Development of highly supercharging the new Wright Cyclone is now under way, and tests to date indicate that this engine will develop over 600 hp. at higher altitudes than have been possible heretofore.

This new 700-hp. Cyclone engine weighs only 10 lb. more than its predecessors, the Cyclone E, which had a Department of Commerce rating of 575 hp. The diameter of the new engine is 53¾ in., or 1 in. less than the previous model.

The government has released this new Cyclone for export. Foreign countries are showing a keen interest in this new design, as is indicated by the fact that orders have been received from the export field for 24 of these engines.

Bendix Electric Brake Unit

AN electric type of brake unit in which the power is derived from the starting motor has been patented in England by the Bendix Brake Corporation and is illustrated by the drawing herewith, which is reproduced from *The Motor* of London. The starter motor shaft is extended and carries a worm, which it drives through a free-wheeling device. When the motor is used to start the engine the worm remains stationary, because of the free-wheeling device. A reversing switch is connected with the brake pedal, and when the pedal is depressed the motor is started and turns in the reverse direction. Under these conditions the starter pinion is not engaged with the flywheel ring, but the worm on the starter shaft is driven through the free-wheeling device. Within the worm wheel driven by the worm there is a spring which expands when the brake pedal is depressed and

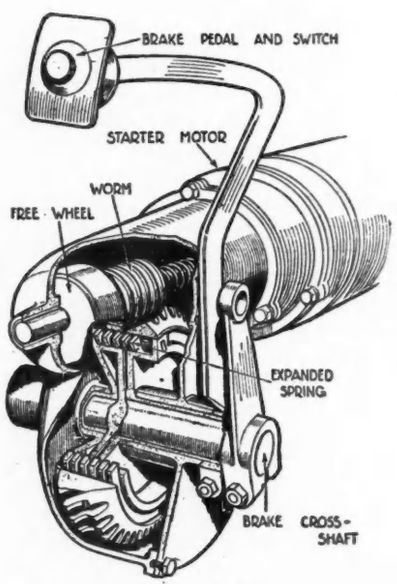


Diagram of Bendix electric brake unit

the motor turns in the reverse direction. Frictional contact with worm wheel then tends to turn the spring around, and in so doing add to the braking effort exerted by the driver directly. By mounting the worm so it can slide along its shaft and away from the jaw clutch by which it is normally driven, it is made possible to apply the brake by foot in the usual way when the electric system fails. Application of the brake then causes the coiled spring to expand and to engage the worm wheel, and the reaction between the wheel and the worm draws the latter away from its clutch.

Compression Ratio and Fuel Economy

THE effects of an increase in the compression ratio on the power and fuel economy of an automobile engine have been studied on a Ford 40 hp. engine by the Benzol Association in Germany. After making tests on the engine with its normal compression ratio of 4.3, the compression ratio was increased to 4.6 by milling 0.060 in. from the cylinder head, and was then further increased to 5.8 by substituting for the regular cylinder heads cylinder heads of the smaller 28-hp. Ford engine, using two gaskets. The tests were carried out in a somewhat unusual manner in that in the first place the peak output of the engine with the original compression ratio was determined, and then the speed which was necessary to develop the same output with the higher compression ratios. Specific fuel consumptions were also determined in each case. Using a fuel known as Aral, which is evidently a benzol mixture, the engine developed 42 hp. at 2300 r.p.m. with its standard compression of 4.3, whereas with a compression ratio of 5.8 it had to run at only 1550 r.p.m. to develop this same horsepower, and the relation between speed and compression ratio is substantially linear. The very considerable decrease in the speed corresponding to a certain hp. is no doubt accounted for in part by the fact that at lower speeds the volumetric efficiency of the engine is increased, besides which, of course, the thermal efficiency is increased with the increase in compression ratio. The fuel efficiency also was greatly increased by the increase in compression, the specific consumption being 0.628 lb. per hp.-hr. with a compression ratio of 4.3, and only 0.507 lb. per hp.-hr. with a compression ratio of 5.8. Tests were also made at lower outputs covering the same factors. The results of the two series of tests are given in the preceding table.

SPEEDS CORRESPONDING TO VARIOUS FULL-THROTTLE POWERS FOR DIFFERENT COMPRESSION RATIOS

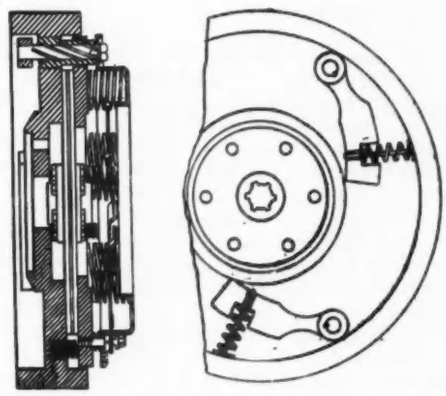
	r = 4.3	4.6	5.8
Hp. = 42	r.p.m. = 2300	2160	1550
40	2010	1960	1460
30	1330	1330	1090
20	880	880	770

SPECIFIC FUEL CONSUMPTION

	r = 4.3	4.6	5.8
Hp. = 42	0.620	0.587	0.510
30	0.590	0.563	0.533
20	0.622	0.593	0.576
40	0.596	0.569	0.512

Automatic Device for Long Clutches

A NEW automatic clutch mechanism has been invented by Charles A. Christos, Jr., and is being applied to Long clutches by Teefey-Seltz Company, Inc., of Philadelphia. The Long clutch consists of a driven member which is compressed between the flywheel and a pressure plate, the pressure being due to coiled springs located between the pressure plate and the cover plate. The clutch is normally engaged, and to disengage it, the pressure plate is withdrawn from contact with the driven member, by means of the clutch pedal and suitable levers.



Cross section through Christos automatic clutch

To convert this clutch to an automatic one the following changes are made: The pressure-regulating bolts between the cover and the pressure plate are backed off sufficiently to relieve the pressure plate of spring pressure. Three small springs are inserted in wells sunk in the flywheel web from the side, these springs holding the pressure plate out of contact with the driven member in the normal or idling position. Next three equidistant holes are drilled through the flywheel web and broached with female splines. Splined bolts are inserted into these holes and secured to the clutch cover. Governor weights are secured to the other ends of the splined bolts, on the forward side of the flywheel.

When the engine with its flywheel is speeded up, the governor weights move outward under the effect of centrifugal force on them, thereby rotating the splined bolts, causing them to move forward, drawing the clutch cover with them and applying the normal force of the clutch springs to the pressure plate. The clutch is then engaged and the drive is transmitted.

When the speed of the engine is lowered by closing the throttle springs on the governor weights force the latter inward and the three springs in the flywheel web force the pressure plate out of contact with the driven plate, so the clutch is disengaged again.

Estimates Place Brewers' First Year Car and Truck Needs as High as $44,000,000

Congress Expected to Act Promptly on President's Request for Legalization of 3.2 Per Cent Drinks

PHILADELPHIA. — Beer, which Congress is expected to legalize before the end of this week, will mean many millions to the automotive industry.

R. A. Huber, vice-president of the United States Brewers Association and of the Anheuser Busch Brewing Co., is on record that brewers will spend $15,000,000 for trucks the moment beer is legalized.

The House Ways and Means Committee was told that in the first year after legalization the brewers will need about 5000 trucks costing about $25,000,000.

Both of these estimates consider only the sale of new trucks to the existing brewers—some 200-odd.

The Huber estimate substantiates a survey of the 200 brewers which revealed that they may buy 4600 trucks at a cost of $13,788,000. The same brewers now operate 4146 trucks. In addition they signified their intention of purchasing 5000 automobiles at a cost of $3,000,000. Cars now in use total 888.

The truck potential is probably greater than any of the above estimates because they do not take into account the mushroom growth which every industry undergoes when its product gains recognition.

Back in 1914 when the brewing vocation was considered an eight-billion-dollar industry, there were 1392 breweries in operation. These breweries supplied the peak consumption of 66,000,000 bbl. of beer in 1914.

John F. Hunt, president of a brewery machinery firm, has declared that there will be 2000 breweries established in the first year of legalized beer. If Mr. Hunt's prediction is fulfilled the 2000 additional breweries should, on the basis of conservative estimates, mean an additional $30,000,000 in new truck sales. This estimate is the result of figuring five trucks per brewery (because most of the new breweries would spring up in the smaller localities where neither the consumption nor the distribution area would warrant more trucks per brewery) at an average cost of $3000, which is the figure developed by the survey of existing brewers.

Using the same averages and assuming that the growth in breweries will not exceed the 1914 total, the 1200 new breweries might be expected to invest $18,000,000 in trucks.

So, considering these "ifs"—and in the circumstance there is nothing else one can consider—the truck industry within a year after legalization of beer may sell to the brewing vocation anywhere from 11,000 to 15,000 new trucks at a cost of from $32,000,000 to $44,000,000.

Early Start on W-O Reorganization Plan Expected Following Appointment of Brown

TOLEDO—Reorganization of the Willys-Overland Co., will be taken up here upon the return to the city in about two weeks of John N. Willys, receiver, and Walter F. Brown, who has just retired as postmaster general.

This was indicated Tuesday when Federal Judge George P. Hahn named the law firm of Brown & Sanger, to serve with Forrest Jeffries, as attorneys for the receivers of the Willys-Overland Co.—John N. Willys and L. A. Miller.

Attorney Charles W. Racine, of the law firm of Williams, Eversman & Morgan, and dean of the law school of University of Toledo, has been named special master to marshal the claims against the company.

Judge Hahn said that the former postmaster general will return to Toledo to resume the practice of law and will give all Willys-Overland matters, especially reorganization problems, his personal attention.

Mr. Brown in addition to his private business is deeply engaged in local politics as the chairman of the executive committee of the Lucas County Republican central committee. He was closely identified with the late Harry Garford in the Garford Truck Co., at Elyria.

Brown & Sanger as counsel take the place of Rathbun Fuller, a director and long-connected with Willys-Overland legal activities, who indicated to the court that he would be unable to serve.

The order issued by the court instructs receivers to publish notice to creditors to file claims within 60 days after publication. They will then be heard and determined by Special Master Racine.

Judge Hahn indicated that he would personally hear litigation dealing with claims of employees of the company for wages and salaries.

NE

First February Sales Reports Show Declines

Spread of Bank Troubles Shrinks Car Purchasing

PHILADELPHIA—February registrations of new passenger cars in the United States totaled about 67,000 on the basis of returns from 13 States and the District of Columbia. This estimate would indicate a decline of 19 per cent for the same month last year and of 25 per cent from January, 1933, using the R. L. Polk estimate for that month.

In the States which have reported on February to date, Ford is ahead of last February by 25.8 per cent, while Plymouth shows a gain of 83.5 per cent. Chevrolet is off 18 per cent from a year ago, despite the fact that in these States it sold 54 per cent of the cars registered in February by the three leaders in the lowest-priced field in this group of States. Together the three low-price leaders ran about 2 per cent ahead of last year in February on the basis of these preliminary figures while all other makes combined show a loss of 42 per cent.

Hudson Report Reflects '32 Volume Curtailment

Operating Loss Increased by Extraordinary Charges

DETROIT.—Hudson Motor Car Co. reports a net loss after depreciation for the year ended Dec. 31, 1932, of $5,429,350. Extraordinary charges amounting to $3,030,632 increased the deficit for last year to $8,459,982. This compares with a net loss after depreciation of $1,991,198, unusual charges of $6,532,708 increasing the 1931 deficit to $8,523,906.

Sales in 1932 amounted to $25,861,671 against $38,235,636 in the preceding year. Current assets at the year end totaled $8,666,423 including cash and U. S. securities of $4,198,518, while current liabilities were $2,200,417. Surplus at the year end amounted to $11,685,521 as compared with $20,145,503 a year earlier.

WS—

Retail Sales Affected Favorably by Bank Reopenings, Reports to Detroit Indicate

Factories Slow in Resuming Production with Few Plants in Operation by Mid-Week—Bank Situation in Michigan Continues an Obstacle

DETROIT—General reopening of banks this week has had a sudden accelerating effect on automobile sales, particular activity being reported from New York, Philadelphia, Boston, Kansas City, Omaha, Atlanta and Florida, according to early reports. The Detroit area has as yet not felt repercussions in this direction. Automotive manufacturers are watching the sales development with interest, but on the whole are reserving conclusions as to the duration of the flurry. One sales manager expressed the opinion that the last 10 days in March would be well below the similar period in any of the last three years.

Despite the opening up of New York and Chicago banks, where the majority of their funds are carried, the car factories were slow in getting under way again this week, although several factories started assembly lines running again on Wednesday, including Hudson, Essex, Plymouth, Packard and DeSoto.

Michigan's smaller automotive concerns with banking facilities mainly confined to Detroit are, of course, in a difficult position and will be seriously handicapped so long as the banking jam continues here. According to the Associated Press, only 162 of the state's 530 banks had reopened by Wednesday.

The key logs in the jam are the Guardian and First National banks in Detroit for which conservators have been appointed. The conservators have made no statement as yet regarding the reopening of these banks except to estimate that if certain unnamed conditions are fulfilled, 50 per cent might become available to depositors with the balance dependent on the realization on slow assets. Consequently when Michigan's banking problem will be settled remains obscure. Under the circumstances, naturally the ending of the national bank holiday has not meant as much here as elsewhere.

February Output Below Forecasts

N.A.C.C. Estimate Puts Member Production 22 Per Cent Under January

NEW YORK—The steady spread of banking difficulties during February had a more depressing effect on motor vehicle production than was anticipated, the preliminary N.A.C.C. estimate of the output of its members being 88,541 units. This represents decreases of 22 per cent from January and 19 per cent from February, 1932. Member production for the first two months of the year is estimated at 202,402 against 220,283 in the same period last year, a loss of 8 per cent.

The N.A.C.C. totals, of course, do not include Ford, but unofficial estimates of his February production do not indicate a grand total for the month of very much over 100,000. This compares with 133,472 in January and 122,895 in February of last year.

Ford May Still Get Into Banking Field

Formation of Entirely New Bank a Possibility

DETROIT.—Henry Ford still remains a potential banking factor in Detroit. Kanzler, who was chairman of the executive committee, Guardian group and president of Universal Credit, is reported to have resigned the latter position. Conferences between the Fords and men at one time prominent in Detroit banking circles are taken as a definite indication that Ford has not given up the idea of controlling his own banking. It is entirely possible that a new bank may be organized by Henry Ford, bearing little relationship possibly to either of the former banks and which will take over his own requirements and the banking for Universal Credit Co. Ford officials refuse to either affirm or deny that such a move is contemplated.

Studebaker Would Add 625,000 Common Shares

Increase Required for Conversion of 6% Notes Issued in White Merger

SOUTH BEND—Authorization for an increase of 625,000 shares in the common stock will be asked of the preferred and common holders of the Studebaker Corp. at their annual meeting on April 25. Stockholders will be asked to empower the directors to make all of the $15,635,000 Studebaker 6 per cent notes, issued in connection with the acquisition of the White Motor Co., convertible into Studebaker common at any time after Dec. 1, 1934, and prior to maturity at the rate of one share of stock for each $25 principal of the notes.

If the privilege of convertibility is not granted before Dec. 1, 1933, according to the notice to stockholders, the notes become payable on Dec. 1, 1934, and unless the holders of 75 per cent of the notes formally request the trustees not to make such declaration. Otherwise the notes mature Dec. 1, 1942. With the present condition of the automobile business, it is pointed out, approval of the proposed increase is of the utmost importance.

Under the terms of the White merger with Studebaker, holders of each share of White stock received $5 in cash, one share of Studebaker common and $25 in Studebaker 6 per cent notes. The notes were made payable on or before two years from date of issue, but the Studebaker Corp. has the option during the first year of substituting for such notes an eight year note exchangeable into the common stock of Studebaker Corp. at any time during the eight year period on the basis of one share of Studebaker common for each $25 of notes.

On Sept. 30, 1932, the Studebaker balance sheet showed 1,894,145 shares of common outstanding. On Oct. 26, 1932, the N. Y. Stock Exchange listed 538,587 additional common shares.

Finance Companies Resume Operations

NEW YORK—Finance companies generally resumed their normal functions this week. Collections naturally were slowed up during the holiday but not to an alarming degree. Moreover, it is confidently expected that with bank deposits again available, past-due accounts will quickly adjust themselves to normal. Dealers in some cases are being asked to assist in collecting.

A report is current that some consideration is being given to the reduction of charges for refinancing unpaid balances where a reduction in monthly payments is desired by the owner, as a measure of cooperation in the present situation. No confirmation of this report has been obtainable.

Big Interest in Car Franchises Among Garages Revealed by Continental Advertising Returns

Independent Shops Say Two-Thirds of Customers Discussing New Car Purchase—Put Economy First and Performance Second Among Selling Features

DETROIT—An analysis of 9500 replies received by the Continental Automobile Company to 58,000 questionnaires sent to independent garages and service stations on the lists of the Chilton Co., publishers of *Automotive Industries*, shows that 91.8 per cent of those replying are interested in a new car franchise both for sales and service.

Of those replying, 8104 answered "yes" to this question while a further 434 were non-committal. Only 355 negative answers were received.

To another question, as to whether customers of such independent garages are discussing new car purchases with them, 5832 replied yes, representing 64.5 per cent. The question was qualified to indicate actual market potential, limiting "yes" answers to conversations with those actually talking of buying a new car.

A rather startling summary of replies to this questionnaire related to the matter of price. Independent garages were asked what price class of cars their customers were interested in purchasing. Of those replying, 5214, or a total of 57.3 per cent, said under $1000 *but over $500.*

According to the replies received such customers are interested primarily in operating and service economy (76.2 per cent gave first place to this item), second place to Performance (52.5 per cent); third place to "beauty" and fourth to "mechanical features."

Replies to a question as to the importance of "dealer guarantees" to the customer, were about evenly divided between "great deal" and "comparatively little," with 48 and 46.2 per cent respectively.

Goods to Dollars and Back to Goods Again

During the 40 months from October, 1929, to March, 1933, prices have been forced steadily downward, due to the furious rate of conversion of goods into dollars.

Are we at the turning point now? Is an era of conversion of dollars into goods about to begin? Some sales executives believe that they see evidences that the reversal in trend already is taking place. If it is, whether it is an effect of currency expansion due to the fact that the public has concluded that prices will be higher before they are lower, it is something for sales and advertising men to think about.

British Makers More Active in Canada

TORONTO—One by one British automotive manufacturers are getting busy in the Canadian market. Armstrong-Siddeley and Austin both have made arrangements for distribution of their cars in the Dominion and Albion is reported to be making sales arrangements. British equipment manufacturers also are becoming more active in this market, one example being the formation of a Canadian company by Fred Pollard, Ltd., of London, England, bearings manufacturer.

Gilmer Expands Sales Force

PHILADELPHIA, PA.—L. H. Gilmer Co. is expanding its sales force by adding the following men: Frank Cuyler and Walter Manton have been recalled and assigned to Brooklyn and New York, respectively; W. Harry Taylor and E. C. Lindsay will operate in the Philadelphia area; Paul Wright, in New Haven and lower Connecticut; C. V. Cook in and around Tampa; H. W. Brennan in the Boston section; J. A. Lyons in Providence and vicinity; W. J. Robinson in the Albany, N. Y. territory, and H. K. Reed in and around Allentown, Pa.

Michigan Sales Still Ahead of '32 Record

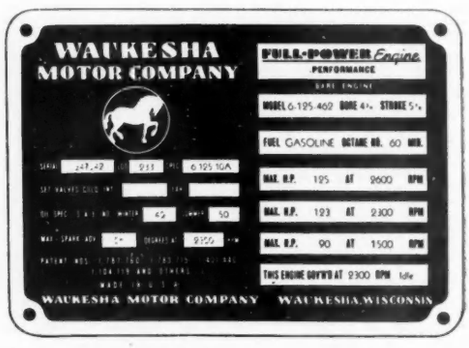
February Decline Due to Wayne County Drop

DETROIT — Although Michigan new car registrations for February showed a decline of approximately 5 per cent from February of last year, this decline was more than accounted for by a drop of 14 per cent in Wayne county registrations. Outside of Wayne county there was a gain in registrations of approximately 15 per cent. The gains were largely accounted for by Chevrolet, Ford, Pontiac and Plymouth who ranked in the order named for total car sales. Total registrations for February were 4063 compared with 4632 for January and 4230 for February, 1932.

This brings Michigan's total registrations for 1933 to date to 8695 representing an increase of approximately 4 per cent over registrations for the first two months of 1932.

Commercial vehicle registrations continued to show a decline with 299 registered in February as against 451 in February of last year and 401 in January of this year.

New Nameplate Gives Needed Operating Data


WAUKESHA
MOTOR COMPANY
FULL-POWER Engine
PERFORMANCE
MODEL 6-195-462 BORE 4½ STROKE 5½
FUEL GASOLINE OCTANE NO. 60 MIN.
MAX. H.P. 195 AT 2600 RPM
MAX. H.P. 193 AT 2300 RPM
MAX. H.P. 90 AT 1500 RPM
THIS ENGINE GOV'D AT 2300 RPM Idle
WAUKESHA MOTOR COMPANY WAUKESHA, WISCONSIN

Rather more than the usual information is conveyed by the nameplates which will be attached to the Full-Power engines of the Waukesha Motor Company, of which a sample is illustrated herewith. On one side of the field are given the identifying marks and information on valve setting, spark setting, and viscosity of lubricating oils recommended, together with a list of patents under which the engine is being manufactured, while on the other side are given the model designation, bore and stroke, the minimum octane number of gasoline which should be used in the engine, maximum horsepowers at three different speeds, and the governed idling speed.

January Instalment Financing Drops 30 Per Cent—Wholesale Off 13 Per Cent

WASHINGTON, D. C.—January retail instalment financing was 30 per cent under a year ago, according to preliminary figures on the operations of 313 finance companies issued by the U. S. Bureau of Census.

Wholesale financing in January showed a smaller decline as compared with last year, the percentage decrease amounting to 13. New car financing was off 22 per cent and used car volume 38 per cent, the difference in the percentage losses probably being attributable in some degree to increases in used car inventories. The average amount financed per car continues to reflect the downward trend of new and used car prices.

Comparative figures for January, 1933, 1932 and 1931 follow:

	Jan. 1931	Jan. 1932	* Jan. 1933
Wholesale Financing Volume	$40,164,672	$34,841,766	$30,201,868
Retail Financing			
Number of Cars	160,490	122,344	(a) 92,284
Total Amount	$61,691,837	$44,628,529	$31,395,476
Amount per Car	$384	$365	$340
Number of New Cars	58,499	41,375	35,566
Amount on New Cars	$32,945,588	$23,475,671	$18,363,929
Amount per New Car	$563	$567	$516
Number of Used Cars	97,834	77,321	54,522
Amount on Used Cars	$27,236,324	$19,974,286	$12,266,354
Amount per Used Car	$278	$258	$225
Number Unclassified Cars	4,157	3,648	2,196
Amount on Unclassified Cars	$1,509,925	$1,178,572	$765,193
Amount per Unclassified Car	$363	$323	$348

* Preliminary
(a) Of this number 38.54 per cent were new cars, 59.08 per cent used cars, and 2.38 per cent unclassified

Plymouth Deliveries Register Big Increase

DETROIT—Plymouth retail deliveries for week ending March 4, were 204 per cent of the same week a year ago and 376 per cent of the same week in 1931, according to a statement by Harry G. Moock, sales manager of Plymouth Motor Corp.

At present there are 32 per cent more orders on the books than at the same time last month, according to the report.

Riordan to Represent Kingsbury

KEENE, N. H. — The Kingsbury Machine Tool Corp. has appointed the Riordan Machinery Company, 213 Curtis Building, Detroit, as their exclusive representatives in the Detroit district.

Edgar S. Porter

LANSING, MICH.—Edgar S. Porter, 82 years, important figure in Lansing's early automotive history, died Sunday.

Mr. Porter was the organizer of the Lansing Spoke Company and in 1910, realizing that the building of automobile wheels would be a prominent industry, converted the company into the Auto Wheel Company. He was president and manager. In 1920 the Prudden Wheel Co., Gier Pressed Steel Co. and the Auto Wheel Company consolidated under the name of the Motor Wheel Corp. He was also one of the organizers of the Auto Body Company, one of the pioneer manufacturers of automobile bodies. He was one of the original stockholders and promoters of the Reo Motor Car Co. and later helped organize the Atlas Drop Forge Co.

Carter Officials Honor Bicknell

ST. LOUIS—Officials of the Carter Carburetor Corporation, on March 11, held a testimonial dinner at the University Club here, in honor of their chief engineer, Geo. M. Bicknell, who has completed his twentieth year with the organization.

At the conclusion of the dinner, Mr. Bicknell was presented with a silver cocktail service of fourteen pieces by Hugh H. C. Weed, vice-president of the corporation.

AC Buys Automatics

DETROIT—National Acme Co. recently received an order totaling $80,000 from AC Spark Plug Co., for 16 model "GA" Gridley automatic screw machines, according to F. A. Spencer, district sales manager. The machines are to be used for manufacture of the shell of the metric spark plugs recently introduced by AC.

License Leniency Coaxes Cars Back

Oregon and So. Carolina Moves to Get Cars Back on Roads Prove Effective

NEW YORK—Idle motor vehicles, known in many states as "frozen assets" since they pay no taxes because they are not used, are being put back on the roads by thousands in Oregon and South Carolina by the simple expedient of postponing the registration date, or reducing license fees, it is indicated in information reaching the American Petroleum Industries Committee.

More than 9000 vehicles, previously idle, now are operating and paying gasoline taxes to Oregon through the passage of a law permitting their licensing upon payment of a fee of only $2.50, with licenses good until July 1 next. The legislature contemplates passing a law materially reducing motor vehicle license fees, but it cannot be made effective before the July 1 date.

South Carolina has extended until March 20 the period for purchasing 1933 licenses, and a bill now before the legislature would extend the date of issuance of license plates from January 1 to July 1. Another bill would reduce license fees.

Who Said It Was Hard To Sell a Used Car?

HARRISBURG, PA. — When the record section of the Bureau of Motor Vehicles some months ago reported an automobile that had had 23 different owners it was believed a record for something or other had been made. Now comes the title section of the same bureau with a car that really has established a record.

Not only has the ownership of this car been transferred 25 different times but for the first time since the title law became effective in 1923, the 23 letter prefixes used with numerals on title numbers have been exhausted. The car now is starting through the alphabet again with AA prefixed to its original title number.

The car first was purchased in November, 1926. Its changing ownership has netted the State $28.50 in title fees; $55 in registration fees, and $6 in transfers of registration fees. It has been licensed for 1933.

Motors Climb as Stock Market Surges Upward Following Trading Resumption

Two and Three Point Gains Common—Accessory Stocks Here in Bullish Tendency of Market

NEW YORK—Motor and accessory stocks shared in the sharp upward movement which lifted to the entire New York Stock Exchange list on Wednesday when trading was resumed. Gains of two and three full points were common with Mack showing the largest increase with a jump of 7⅜. Comparison of "last" prices follows:

Motors

	Last Price Mar 4	Last Price Mar. 15	Change
Auburn Automobile Co.	35½	40¼	+4¾
Checker Cab Mfg. Co.	19	19	.....
Chrysler Corp.	8⅛	10⅞	+2¾
General Motors	10¾	13¾	+3
General Motors, pf.	66	69½	+3½
Graham Paige Motors	1¼	1¾	+ ½
Hudson Motor Car	3⅛	4⅛	+1
Hupp Motor Car	1¾	2⅛	+ ⅜
Mack Trucks	15	22⅜	+7⅜
Marmon Motor Car	¾	⅞	+ ⅛
Nash Motors	12¾	14¾	+2
Packard Motor Car	1⅞	2½	+ ⅝
Reo Motor Car	1½	2¼	+ ¾
Studebaker Co.	2½	3⅛	+ ⅝
Studebaker Co., pf.	20	20⅛	+ ⅛
Willys-Overland	⅜	⅜	.....
Yellow Truck & Coach	2⅝	3¾	+1⅜

Accessories

American Car and Foundry	7	9½	+2½
American Car and Foundry, pf.	15⅛	19	+3⅞
Bendix Aviation	7⅝	9¾	+2⅛
Bohn Aluminum and Brass Corp.	9½	13	+3½
Borg-Warner Corp.	6¾	8⅛	+2⅛
Budd (E.G.) Mfg. Co.	1⅛	1¼	+ ⅛
Continental Motors Corp.	1⅜	1⅝	+ ¼
Eaton Mfg. Co.	3⅜	4⅝	+1¼
Electric Auto-Lite Co.	12½	13½	+1
Electric Storage Battery Co.	23	23½	+ ½
Evans Products Co.	⅞	1	+ ⅛
Hayes Body Corp.	⅞	1¼	+ ⅜
Houdaille-Hershey Corp.	1¼	1⅜	+ ⅛
Midland Steel Products Co.	3½	5	+1½
Motor Products Corp.	9	12	+3
Motor Wheel Corp.	1⅝	2⅛	+ ⅝
Raybestos-Manhattan, Inc.	5⅞	6½	+ ⅝
Stewart-Warner Corp.	2⅝	3⅛	+ ½
Timken-Detroit Axle Co.	2	2½	+ ½
Timken Roller Bearing Co.	14¾	16⅝	+1⅞

N. Y. Curb

Cord Corp. (10c)	5	6⅝	+1⅜

Freight Surcharges End on September 30

Extension Granted to Allow Rails Time for Rate Changes

WASHINGTON.—Railroad freight surcharges will be discontinued on Sept. 30. These additional carrying rates became effective on Jan. 4, 1932, and were to have expired on March 31 of the present year. The railroads, however, asked for their continuance, met with much more opposition from shippers than was expressed when they originally asked for additional rates, and succeeded only in having the surcharge continued six months or until Sept. 30, instead of indefinitely as they had attempted. The Interstate Commerce Commission decision granting the six months' extension appeared to have been made reluctantly. For it said it thought the surcharges "as such" should be brought to an end. But it decided to allow a "reasonable period" during which time the railroads will be given opportunity to file new tariffs.

This means that the railroads may incorporate in the forthcoming tariffs prevailing surcharges and make them a part of new basic rates. However, in view of low traffic movement, attributed partly to high freight rates, and motor truck competition, the railroads are being compelled in many cases to reduce rather than raise rates. The attitude of the railroads likely is uncertain and their action under the Commission decision is expected to be controlled by business conditions existing at the expiration of the six-month period.

Banking Difficulties Cut Maryland Sales

BALTIMORE—Maryland registration records for the first ten days of March reveal the serious effect the state and subsequent national banking holiday has had on motor vehicle sales. Registrations of new passenger cars during the ten-day period totaled only 216 against 490 in the same period last year, while commercial vehicle sales for the corresponding periods dropped from 79 to 36.

Rim Inspections Down in February

CLEVELAND—Rims inspected by the Tire and Rim Association amounted to 579,789 in February against 726,172 in the same month a year ago, a loss of 20 per cent. For the first two months of the year inspections totaled 1,307,097, as compared with 1,536,931 for the corresponding period last year, the percentage decline being 15.

Cord Gets Control of Aviation Corp.

Becomes Board Chairman and Names L. B. Manning President

NEW YORK.—With the election of L. B. Manning to the presidency, the campaign waged by E. L. Cord for control of the Aviation Corp, apparently is brought to a successful conclusion. Mr. Cord is now chairman of the board and the following new officers have been elected: Raymond Pruitt, secretary; L. L. Young, vice-president, and T. J. Dunnion, treasurer.

In a statement issued by Richard F. Hoyt, retiring president, he said: "E. L. Cord has advised the directors of the Aviation Corp. that he and his associated interests have greatly increased their holdings of the stock of the company and now have effective control, and that he therefore desired to take full responsibility and direction of the corporation's affairs, select a majority of the directors and move the corporation's offices to Chicago.

Directors Cohu, Hann, Harriman, Lawrance, Morton and Sloan resigned at the same time as Mr. Hoyt.

The board of directors now consist of the following: Mr. Cord, president of the Cord Corporation; L. B. Manning, vice-president of the Cord Corporation; R. S. Pruitt, general counsel of the Cord Corporation; Amon G. Carter, publisher, of Fort Worth, Texas; Frank A. Vanderlip of New York, Carle C. Conway, chairman of the Constinental Can Company; C. Coburn Darling, Lester D. Seymour, president of American Airways, operating subsidiary of the Aviation Corporation, and Lyndol L. Young of the Cord Corporation.

Westinghouse Merges Aviation Activities

EAST PITTSBURGH, PA.—Consolidation of its widespread aviation activities under one head was announced today by the Westinghouse Electric and Manufacturing Co.

The various sales and engineering departments involved in aviation activity have been coordinated in the transportation sales department under the direction of M. B. Lambert, sales manager. A. P. Schrader will directly supervise the headquarters organization.

Finance Companies Advised to Resume Normal Business

CHICAGO—The National Association of Finance Companies announced yesterday it would advise its 300 members to resume normal business operations immediately. C. C. Hanch, general manager, made the announcement following receipt of a telegram from Mason B. Williams, organization counsel in Washington, D. C., which stated:

"Official interpretation of orders to state banking superintendents makes them official agents of the Treasury and authorizes them to authorize normal functions and operations of finance companies without delay. Suggest repeating this advice to membership."

Mr. Hanch said the advice would be relayed at once to member companies, which handle the bulk of automobile financing in the United States.

German Maker Gets Ross License

A license for the manufacture of Ross steering gears in Europe has been secured by the Zahnradfabrik Friedrichshafen (Friedrichshafen Gear Works), a subsidiary of the Zeppelin corporation. Ross steering gears were exhibited by the firm at the recent Berlin automobile show.

Earnings Reports

	Net Income After Depr., Int., Etc. 1932	Net Income After Depr., Int., Etc. 1931
Thompson Products, Inc.	d$182,098	d$106,338
McCord Radiator Co.	d649,109	d283,948
McQuay-Morris Mfg. Co.	349,190	472,629
Mullins Mfg. Co.	d696,108	d50,975
Motor Products Co.	d518,007	d18,461
Hudson Motor Car Co.	d5,429,350*	d1,991,198*
Spicer Mfg. Co.	d1,414,315	d1,015,630
Timken Roller Bearing Co. ...	d482,827	2,571,241
Doehler Die Casting Co.	d98,497	139,111

d Deficit.
* Not including write-offs and adjustments of $3,030,632 in 1932 and of $6,532,905.

Davidson Gets More Duties

DETROIT—William J. Davidson, fomerly secretary of the general technical committee of General Motors Corp., under O. E. Hunt, has been

William J. Davidson

appointed technical director of the Buick-Olds-Pontiac Sales Co., under W. A. Blees, general sales manager. Mr. Davidson continues in his activities with the general technical committee in an advisory capacity.

New Taylor Plant to Start in May

PHILADELPHIA—The new plant of Taylor & Company at Betzwood, Pa., about 20 miles from here, manufacturers of vulcanized fiber and phenol fiber, will begin operations the early part of May. The plant is entirely new and is equipped with machinery of special design enabling the company to take advantage of the latest improvements in methods of manufacturing which tend toward higher quality and decreased production costs.

The officers of Taylor & Company are John M. Taylor, president; L. T. McCloskey, sales manager, and C. N. Jacobs, plant manager, all of whom held similar positions until recently with the Continental Diamond Fiber Company and its subsidiary, the Celeron Company.

Auto-Lite Defers Dividend Action

TOLEDO.—Directors of Electric Auto Lite Co. meeting in New York today voted to defer action on common dividend until June, due to present uncertain business conditions. Regular preferred dividend $1.75 was voted payable April 1 to holders of record March 25.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

General business last week was, of course, retarded by the National banking holiday. However, despite the inconveniences, and in some cases hardships, occasioned by the inability to withdraw funds from the banks, the patience and courage of the American people were reassuring. Encouragement is also found in the steadiness of commodity prices during the banking crisis.

FREIGHT LOADING INCREASES

Railway freight loadings during the week ended March 4 amounted to 477,827 cars, which marks an increase of 18,748 cars above those during the preceding week, but a decrease of 81,652 cars below those a year ago and a decrease of 245,388 cars below those two years ago.

POWER PRODUCTION BELOW 1932

Production of electricity by the electric light and power industry in the United States during the week ended March 4 was 6.4 per cent below that in the corresponding period last year.

AGRICULTURAL PRICES DROP

The general level of prices paid to producers of agricultural commodities on Feb. 15 stood at 49 per cent of the pre-war average, the lowest on record, as against 51 per cent a month earlier and 60 per cent a year earlier.

CONSTRUCTION QUIET

Construction contracts awarded in 37 eastern States during February, according to the F. W. Dodge Corporation, totaled $52,712,300, as compared with $89,045,800 during the corresponding month last year.

CRUDE OIL

Average daily crude oil production in the United States for the week ended March 4 amounted to 2,147,900 barrels, as against 2,192,600 barrels for the preceding week and 2,140,850 barrels a year ago.

FISHER'S INDEX

Professor Fisher's index of wholesale commodity prices during the week ended March 11 was not compiled because of the temporary closing of commodity exchanges.

AMERICAN SECURITIES RISE IN LONDON

Stock exchanges throughout the country were closed last week. However, quotations for American securities on the London stock market showed a rising tendency despite the banking holiday in this country.

FEDERAL RESERVE REPORTS

The consolidated statement of the Federal Reserve banks for the week ended March 8 showed increases of $702,000,000 in holdings of discounted bills, of $33,000,000 in holdings of bills bought in the open market and of $45,000,000 in holdings of Government securities. The Reserve ratio on March 8 was 45.6 per cent, as against 53.5 per cent a week earlier and 61.2 per cent two weeks earlier.

Cadillac Advances Thompson and Nacker

DETROIT — The Cadillac Motor Car Co. has announced that Earl A. Thompson, assistant chief engineer, has been made special assignment engineer to head a new department created by the engineering division of Cadillac.

Mr. Thompson is the inventor of the famous syncro-mesh transmission,

(Left) Earl A. Thompson
(Right) O. M. Nacker

which was developed in the Cadillac engineering division under the direction of Mr. Thompson and Ernest W. Seaholm, chief engineer.

Mr. Seaholm has appointed O. M. Nacker, of his engineering staff, to succeed Mr. Thompson. Among his important achievements during his six years with the Cadillac Motor Car Co. have been the designing of the Cadillac V-16 and V-12 engines.

C.N.R. and C.P.R. Extend Store Door Delivery

TORONTO, ONT. — An important development in freight service of the Canadian National and Canadian Pacific Railways, which will provide door-to-door pickup and delivery of freight shipments without extra cost to either shipper or consignee was announced jointly today by George Stephen, vice-president in charge of traffic of the Canadian Pacific Railway, and Alistar Fraser, K. C., acting vice-president in charge of traffic of the Canadian National Railways. The two railways have completed contracts with approximately forty-five truck firms at cities and towns served by their lines in Western Ontario, between Toronto and Windsor, and Toronto and Sarnia, whereby pickup and delivery service will be provided for shippers at no extra cost. New tariffs embracing this feature are now in effect. The railways, it is emphasized, are not entering the trucking business. At some of the points affected by the new tariffs they already have contracts with cartage firms for pickup and delivery of freight. Under the present plan, however, this service is extended, by arrangements with local trucking contractors to points where pickup and delivery service did not previously exist. For the present this trucking service will be confined to these districts only.

No Subsidy for Motors in Federal Aid Roads

Congressional Committee Report Refutes Railroad Charge of Favoritism

WASHINGTON, D. C. — Charges that commercial motor vehicle transportation is subsidized in the use of Federal aid highways are repudiated in the Report of the Special House of Representatives Committee appointed to investigate Government competition with private enterprise.

While the investigation embraced all phases of Government competition with private enterprise, the question of whether or not Federal highway aid subsidizes trucks and buses was raised by railroads who charged that the Government permits commercial buses and trucks to use highways, free of any substantial part of the cost of construction and maintenance.

The Committee reported it is apparent from a review of these facts that "Federal highway appropriations do not constitute a subsidy to commercial motor carriers on the highways, since the appropriations originated prior to the development of any appreciable commercial movement; they are made in the interest of the nation as a whole; they offset to some extent the Federal use of the highways; they represent the national interest in the flow of interstate commerce; and they provide a stabilizing coordinating influence in the expenditure of large sums of money."

Railroads submitted testimony at hearings in several cities. A brief was filed on behalf of motor transportation by the National Automobile Chamber of Commerce.

Black Displaces Blue

WILMINGTON, DEL.—Black has edged slightly ahead of blue as the current automotive color favorite. Blue has lost ground in approximate proportion to black's gain. Purple blues of extremely low value and maximum Chroma strength continue in high favor.

L. E. Jamme

Mr. L. E. Jamme, advertising manager of Hilo Varnish Corporation, died after an operation in a Brooklyn hospital on Friday, March 3, 1933. Mr. Jamme had been associated with Hilo since 1915.

Plymouth Doubles Share of Market

DETROIT—Based on automobile registration figures thus far available for 1933, Plymouth has increased its percentage of the low-priced field from 9.1 per cent during January, 1932, to 21.6 per cent for the same period in 1933, according to statement by H. G. Moock, general sales manager of Plymouth Motor Corp.

Latest available registration figures including 39 states, show that the three leaders in the low price market registered 45,823 cars in January of this year against 43,870 in 1932.

"Last year in January, Plymouth registered 3976 cars against 9901 for January of this year, an increase of 149 per cent," Mr. Moock said.

Hupp Appoints Wilcox

DETROIT—Rufus S. Cole, vice-president in charge of domestic and export sales of Hupp Motor Car Corp., has announced the appointment of Verne H. Wilcox as export manager succeeding Fred B. Sides, who died Feb. 27. Mr. Wilcox has been assistant export manager for the past eight years and has been with the corporation since 1915.

He has been a director and is now vice-president of the Detroit Export Club.

DeSoto Volume Continues Upward

DETROIT—According to a statement by L. G. Peed, general sales manager of DeSoto Motor Corp., retail deliveries by DeSoto dealers jumped for the week ending March 4, to a total of 840 cars. Unfilled retail orders in the hands of dealers are 126 per cent of what they were at this time a year ago. A marked decrease in dealers' used car stocks was also reported.

On March 7, three days after the bank holiday had been made national, orders were received from dealers for 419 automobiles for immediate shipment.

Linn to Represent Ex-Cell-O Corp.

DETROIT—Ex-Cell-O Aircraft & Tool Corp. has appointed Ray Linn, Toledo, Ohio, to represent them in the Toledo territory, effective as of March 1.

Mr. Linn will represent Continental Tool Works and Krueger-Wayne Tool Co., divisions of Ex-Cell-O as well as all products of Ex-Cell-O.

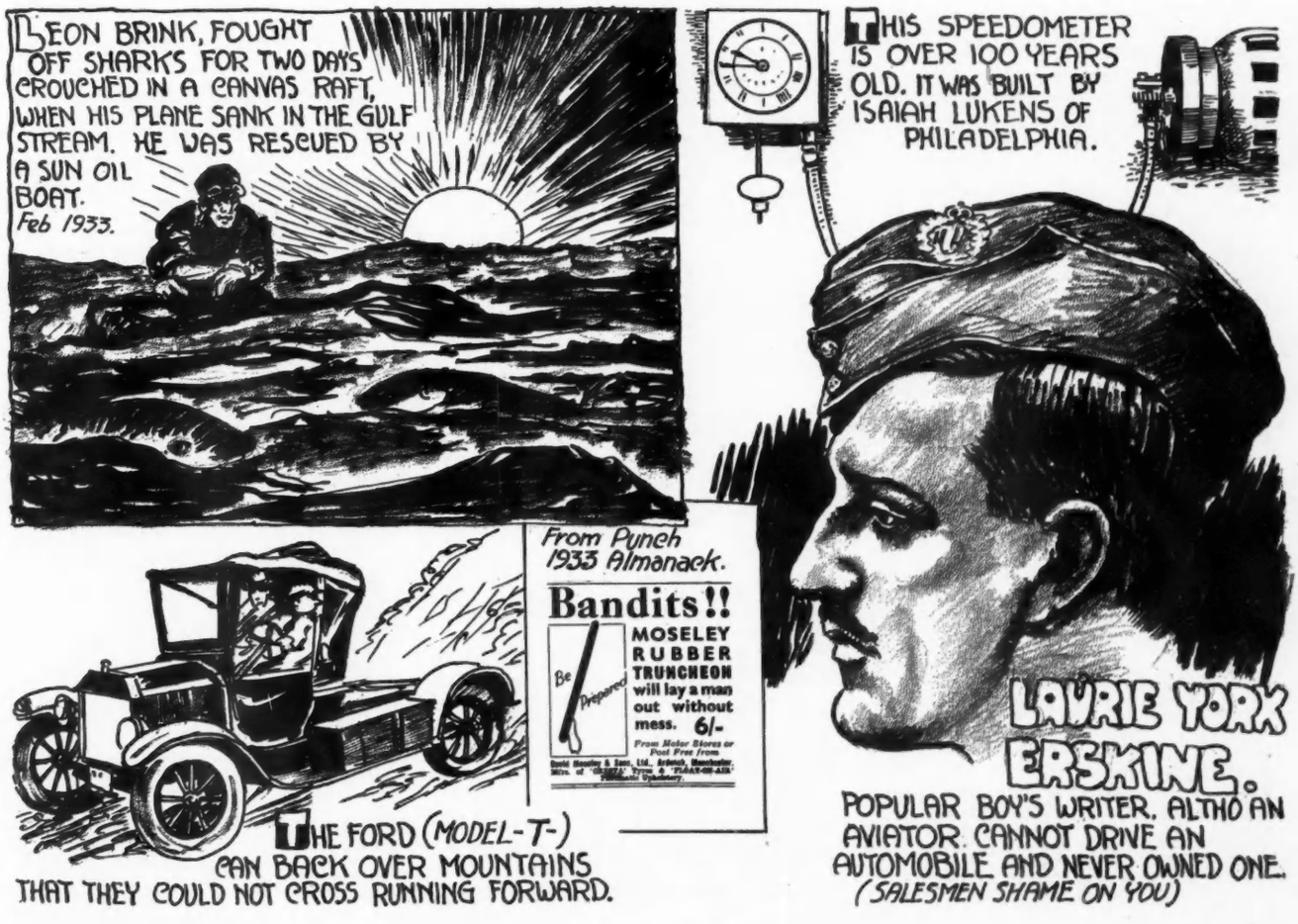
George Shaw Anderson

DETROIT — George Shaw Anderson, personal secretary to Lawrence P. Fisher, president of Cadillac Motor Car Co., and formerly a secretary to Henry Ford, died Friday of a heart attack. He was 56 years old.

He was secretary-treasurer of Wills St. Clair Co. after the war.

Automotive Oddities—By Pete Keenan

Write us if you know an Oddity


LEON BRINK, FOUGHT OFF SHARKS FOR TWO DAYS CROUCHED IN A CANVAS RAFT, WHEN HIS PLANE SANK IN THE GULF STREAM. HE WAS RESCUED BY A SUN OIL BOAT. Feb 1933.
THIS SPEEDOMETER IS OVER 100 YEARS OLD. IT WAS BUILT BY ISAIAH LUKENS OF PHILADELPHIA.
From Punch 1933 Almanack.
Bandits!!
MOSELEY RUBBER TRUNCHEON will lay a man out without mess. 6/-
Be Prepared
From Motor Stores or Post Free from
THE FORD (MODEL-T-) CAN BACK OVER MOUNTAINS THAT THEY COULD NOT CROSS RUNNING FORWARD.
LAURIE YORK ERSKINE.
POPULAR BOY'S WRITER, ALTHO AN AVIATOR. CANNOT DRIVE AN AUTOMOBILE AND NEVER OWNED ONE. (SALESMEN SHAME ON YOU)

Priority for Back Pay Asked by W-O Workmen

Want Property Sold to Meet $450,000 Claims

TOLEDO.—Filing an intervening petition here in Federal Court in the Willys-Overland receivership case, a committee representing 8000 workmen at the plant, asked that wage claims aggregating $450,000 with the largest individual claim not more than $300, be declared a prior lien and the property sold to discharge the obligation.

Attorneys for the workmen charged in their petition that the National City Bank and the Ohio Savings Bank & Trust Co., of Toledo, now in the hands of the state superintendent of banks, are trustees under a bond issue on which there is $2,000,000 plus $10,000 back interest outstanding.

The employes charge that at the time $1,000,000 of the bonds went into default last summer the trustees and bondholders were aware of the fact that the company had $10,000,000 of liabilities and $4,000,000 of current assets but that workmen had no knowledge that the company was in such shape. It is charged that the bondholders, by remaining silent, conspired unlawfully against the employes.

It is also declared in the petition that certain creditors were paid large sums creating a preference over the claims of the employes.

The court is asked to order the receivers to sell property of the company to pay the wage claims or issue receivers' certificates if property cannot be sold to satisfy the claims.

Operations of the plant were interfered with by the banking holiday which tied up funds of the receivers temporarily. With release of the funds, however, the workers who have been employed recently were paid and plant operations are scheduled to start within a few days.

Orders for 4400 trucks for International Harvester Co. have been received and authorized to be completed by the court.

Dardelet Licenses Scovill

NEW YORK.—The Scovill Mfg. Co. of Waterbury, Conn., has been licensed by the Dardelet Threadlock Corp. to manufacture and sell "rivet-bolts" and other bolts and nuts with the Dardelet self-locking thread.

G.M. Stockholders Now Total 372,284

NEW YORK.—The total number of General Motors common and preferred stockholders for the first quarter of 1933 was 372,284, a new high figure, compared with 365,985 for the fourth quarter of 1932 and with 345,194 for the first quarter of 1932.

There were 354,516 holders of common stock and the balance of 17,768 represents holders of preferred stock. These figures compare with 348,247 common stockholders and 17,738 preferred for the fourth quarter of 1932.

Dodge Sales Gained 8.3 Per Cent in Week

DETROIT—During the week ending March 4, retail sales by Dodge dealers of Dodge and Plymouth passenger cars, rose 8.3 per cent over the previous week's level. Sales of Dodge trucks fared even better, going 11.8 per cent over the record of the previous week.

Further tabulation of Dodge dealers' deliveries of Dodge and Plymouth passenger cars and Dodge trucks reveals that sales this year to date are 35 per cent ahead of passenger car and trucks sales made during the corresponding period of 1932.

M.E.W.A. in Canada

CHICAGO — Automotive jobbers from Quebec and Ontario met recently at the Royal York Hotel, Toronto, and formally organized an M. E. W. A. regional group, officially named "The Motor and Equipment Wholesalers Association—Eastern Canadian Division."

CALENDAR OF COMING EVENTS

MEETINGS

American Chemical Society, Washington, D. C. ..... March 26-31

National Machine Tool Builders Assoc. Annual Meeting, Cleveland, April 24-25

Natl. Foreign Trade Council, Annual, Pittsburgh ..... April 26-28

U. S. Chamber of Commerce Meeting, Washington, D. C. ..... May 2-5

American Gear Mfg. Assoc., Wilkinsburg, Pa. ..... May 4-6

Natl. Automobile Chamber of Commerce, Annual, New York City. June 8

Natl. Retail Hardware Assoc., Indianapolis ..... June 12-16

American Society for Testing Materials, Chicago ..... June 26-30

Automotive Engine Rebuilders Assoc., Annual, Chicago ..... July 10-14

Natl. Safety Council, Chicago .... Oct. 2-6

National Metal Congress, Detroit. Oct. 2-6

American Petroleum Institute, Annual, Chicago ..... Oct. 24-26

Non-Ferrous Metals Rise But Steel Holds Steady

Copper, Tin, Lead and Zinc All Move Higher During Banking Holiday

NEW YORK—While the week's developments had no effect on the steel market's price structure, that of non-ferrous metals underwent spectacular upward revision in spots. Copper, for weeks and weeks neglected while freely offered at 5c., came in for fair demand as soon as prices tended higher. There were quite a few transactions when the market advanced to 5½c. and when 5¾c. was reached, a number of the larger producers withdrew from the market in the expectation of still further advances.

In the absence of "official" statistics, an estimate that domestic stocks of the metal at the beginning of the year stood at approximately 650,000 tons, emanating from one of the producers, came in for considerable attention. Anything like runaway market conditions could hardly be imagined with such an accumulation, but the 4c. per pound duty protecting the domestic industry is now for the first time making its effect felt, the disparity between domestic and export prices becoming more pronounced.

Tin, because of the uncertainty at first of what the Sterling exchange situation would be, was at first nominally quoted approximately 2c. per pound higher, but the quotation was lowered when it was found that the relation between the dollar and the pound sterling had altered considerably less than it was at first thought.

A heavy business was done in lead at an advance of $5 per ton, but when the market rose a further $2, making the increase $7 per ton in all, demand quieted down. Zinc came in for a gain of $3 a ton.

Quotably unaltered, the undertone of the steel market, however, reflects the increased confidence in the future and prices named by sellers are looked upon as being more nearly the actual market than they have been in a long while. There were few out-and-out cancellations of automotive specifications as the result of the bank holiday, but in a good many cases postponement of shipments was asked.

Pig Iron—The movement of iron to automotive foundries was temporarily slowed down by the bank holiday. Prices remain nominally unchanged, but blast furnace interests are less eager to commit themselves on the prevailing price basis, preferring to await developments.

Aluminum—The advance in the copper market theoretically benefits the aluminum market which, however, for the time being rules very quiet.

Copper—Copper and brass products prices have been advanced to bring them into line with the higher price for the unwrought metal. Copper alloy ingots underwent two upward advances of ¼ cent per pound each.

Tin—Straits tin for prompt delivery was quoted on Monday at 24 cents.

Lead—The leading interest's contract price at the beginning of the week stood at 3.35 cents, New York.

NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

American Bell Type Retort Furnace

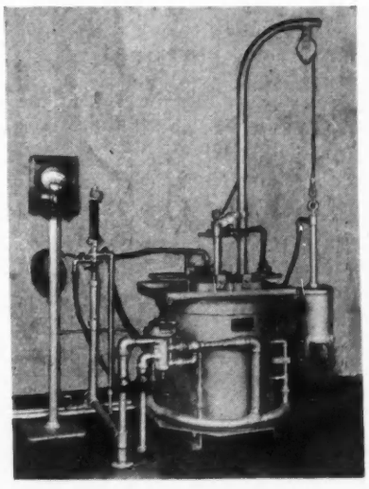
An unusually versatile piece of heat treating equipment is offered by the American Gas Furnace Co., Elizabeth, N. J., in their bell type retort furnace which is adapted for carburizing, nitriding, or processing in other gaseous atmospheres. This atmosphere may be either a carburizing hydrocarbon gas, ammonia for nitriding, or a neutral or inert gas for bright annealing, etc. Equipment, according to the manufacturer, can also be used for hardening, normalizing, annealing and tempering.

Because of the wide range of heat treatment possible, this euipment is ideal for the jobbing shop where a great variety of work is handled from day to day. For the larger shop it is equally desirable because a battery may be installed and carburizing or other heat treating operations may be carried on simultaneously.

Where comparatively slow cooling is satisfactory, the bell with its base and work may be removed from the furnace and air cooled or placed in a pit or insulated shop can for relatively slow cooling.

Quenching direct from furnace temperature can be accomplished either by removing the bell, allowing the work on the base to remain in the furnace for removal of the individual pieces and quenching, or, as for example in the case of ring gears or other comparatively large gears, a special yoke may be used to elevate the base and work slowly so that the individual gears may be withdrawn and quenched in a jig, fixture, or quenching machine, as desired.

These various advantages are obtainable in furnaces of the correct size for the work to be done. The bells are not necessarily cylindrical in shape but may be rectangular or may take some other shape if better adapted to the particular work. In addition, uniform results are obtained because the retort is entirely enclosed in the furnace, thus making it possible to maintain it very uniformly at the desired heat.



Campbell "Hudorkut"

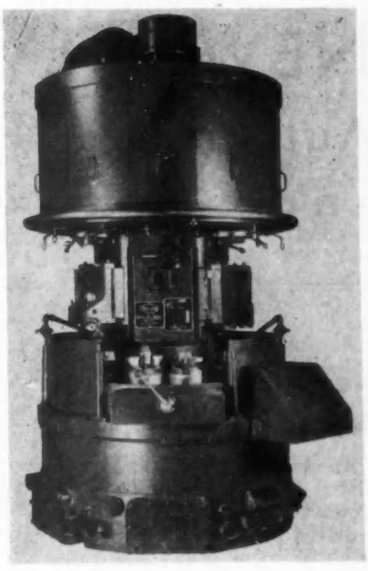
The Campbell "Hudorkut," a new machine for cutting materials has recently been placed on the market by Andrew C. Campbell, Inc., Bridgeport, Conn. It cuts a wide variety of substances, such as metals, alloys, stone, asbestos, rubber, porcelain, glass, bakelite, marbelette, phenol, resin and a host of other materials.

The cutting is done with the piece immersed in a bath. by a thin wheel or disc rotating at high speed. The cut is clean and smooth, said to be without glazing, burring or burning, and generally no further machining or finishing is needed on the cut face. Time is saved in cutting, and there is an after saving by the elimination of further operations.

Immersion of the work in a bath during cutting does away with the need for a suction fan as there is no dust. The bath also increases the life of the cutting wheel. The cutting stroke is automatic and independent of the operator once the machine has been set. This makes possible the use of thinner wheels and more uniform and cleaner cuts. As the material is not visible to the operator, a pilot light indicates when the cut has been completed.

Twin-Six-Spindle Mult-Au-Matic

In announcing the Type "F" Twin-Six Mult-Au-Matic, The Bullard Company Bridgeport, Conn., has again come forward with an advanced step in multiple spindle machines. This machine, while basically the conventional Mult-Au-Matic, has twin spindles at each of the six stations, making a total of twelve spindles. At every single index, two spindles are



presented at each column face, where duplicate tooling performs identical operations on work in each of the twin chucks; thereby doubling the productive output from one machine at only a slightly greater investment.

The capacity of the machine places it in the class of 7 in. work where boring, turning, facing, drilling, and reaming are the requirements, and as this size work runs to higher speeds, the machine may be ordered in either high or low speed ranges. By means of change gears, the high speed range runs from 112 to 1008 with feed changes from .0031 to .0281; the low speed range variable by change gears has speeds from 46 to 417 r.p.m. with feed changes from .0075 to .0678.

An automatic chucking mechanism has been incorporated in the design of the machine to be used for such special chucks or fixtures as the work may require.

All spindles are carried on preloaded roller bearings adequately and automatically lubricated with clean oil. In addition, ball bearings are used in such places throughout the machine as experience has dictated is the best practice. This use of ball bearings assures a smooth flow of power delivered at the point of cutting.

For work requiring drilling operations, duplex live-spindle Drill Heads may be applied at any working station. Variable individual spindle speeds on these Drill Heads may be obtained by change gears. In cases where multiple drilling is necessary, heads can be supplied to meet these specian requirements.

The base machine weight is 18,000 lb. with a projected floor space of 63 in. in diameter, plus space of 43 in. x 20 in. for the Chip Pan. The height from floor to motor base is 124 in. with whatever additional height may be required for motor. Motor horsepower, according to work requirements, may run up to a maximum of 35.

NEW DEVELOPMENTS
Automotive Parts, Accessories and Production Tools

Stewart-Warner Windshield Wiper

An engine-driven dual windshield wiper has been developed by the Stewart-Warner Corp. of Chicago. It is driven by a flexible shaft, operated by a cam. One advantage claimed for this is that the action is positive, instead of intermittent, as is the case with the vacuum-operated wipers. An advantage is claimed also over the electric drive, in that the speed of the wiper increases with the speed of the car, so that when the car is being driven fast into a storm, the cleaning action is faster than when it is driven slowly.

The windshield wiper mechanism is located under the cowl, and when not in use the blades are "parked" below the windshield and do not interfere with the driver's vision. A panel button controls a clutch located adjacent to the camshaft.

Each wiper blade clears an arc of about 150 deg. As the illustration shows, the blades wipe downward instead of upward, and thus snow or rain which has once been wiped off cannot run back on the cleared surface. Provisions are made to protect the blades from injury should they be frozen to the windshield. The blades are automatically disengaged while the windshield is opened, and reengaged when it is closed.

Thomas Coated Strip Steels

A full line of coated strip steels has been designed by the Thomas Steel Co., Warren, Ohio, with the view of eliminating the plating operation after formation of the finished part. Zinc coated, copper coated, and tin coated steels are adaptable for deep stamping, forming, and drawing operations, and the plated coatings being soft and ductile will not crack or peel and are said to aid materially in the drawing operation.

Each type of coating, of course, has its own particular qualification and is selected with regard to the service it is required to give. While all three are somewhat less porous than hot dip coatings and have a greater proportionate value as a rust-resistant, the zinc coating is much superior in this respect to copper or tin.

Zinc plated steel is being used to very good advantage on window screen frames, automobile hub caps, hardware, rolling doors and various other commodities which are exposed to the weather.

Copper coated steel and tin coated steel are desirable more as a finish than rust-resistant qualities and they are used chiefly for parts which remain inside and which do not come in contact with extreme weather conditions. A considerable amount of these products are used in the manufacture of moldings, hardware, and small parts, which are subsequently buffed and then lacquered to preserve the finish.

Ex-Cell-O Boring Machine

Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich., announces that steel parts may be bored with both their single and double end precision boring machines.

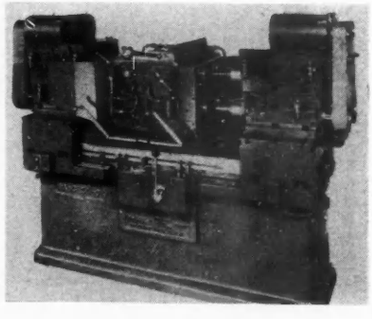
In developing this application it has been found that steel parts which do not exceed a hardness of 250 Brinell, 36 Scleroscope or 24 Rockwell, can be successfully bored, providing the hardness of the steel is uniform, with no hard spots in different sections and that the stock to be removed is well distributed throughout the entire bore.

Illustrated is a double-end precision boring machine designed for finish-boring both the large and small end of the connecting rod in one operation. On the large end, the material to be bored is steel; on the small end, bronze. Approximately 0.018 in. to 0.020 in. steel stock and 0.008 in. to 0.010 in. bronze stock is removed in the same operation.

The holding fixture is so designed that two rods are loaded at each end in a vertical position with the small end of the rod at the top. This enables the operator to load two rods at one end while two rods are being bored at the opposite end, eliminating the loading time.

An inbuilt direct-connected electric motor drives the unit for boring the bronze end of the rod. This unit is located at the top of the mounting bracket. At the bottom of this bracket is located a belt-driven boring spindle for boring the steel end of the rod. The motor for driving this spindle is mounted on top of the bracket. By means of the belt-driven spindle the proper boring speed can be obtained for the steel application. There are two sets of these units at each end of the machine.

Each of the boring spindles are of the replaceable quill type, enabling the operator to keep an extra set of sharp boring tools available at all times. The maintenance of sharp tools properly designed is an important factor in determining the successful operation of this machine.



Joint Symposium of S. A. E. and A. S. T. M.

(Continued from page 339)

sirable. However, the difficulty is that the public has become educated to use heavy bodied oil in warm weather regardless of the specifications. This habit will be hard to break and will require considerable education on the part of the petroleum refiners.

M. A. Dietrich of the Ohio State University read a very interesting paper "Service Changes in Crankcase Lubricating Oils" which brought together a mass of information on the subject from published literature as well as original test work. Briefly, the author makes the following point:

"Used crankcase oils generally show a marked decrease in viscosity, flash and fire points, and pour point because of dilution. A decided increase is noted in the carbon residue and ease of emulsification with water. The extent of change which these characteristics undergo bears *no* relation to the original characteristics of the oil. The presence of dilution appears to reduce the slope of the viscosity-temperature curves for those oils whose viscosity-temperature curves are steep.

"The diluent consists of high boiling material possessing a considerable degree of unsaturation. Sludge formed in the oils consists mainly of carbonaceous material formed by cracking or partial combustion of either the lubricating oil or the fuel. The quantity of sludge formed cannot be related to the oxidation resistance or carbon residue of the oil but bears some relation to oil consumption. The quantity of ash-forming constituents is determined by the viscosity of the oil at the time of service, the length of service, and the characteristics of the engine. In Diesel engines the sulphur content of the sludge is fairly high and varies with the sulphur content of the fuel oil.

"The distillation curves of oils used with normal quantities of make-up oil are not greatly different from those for the new oils unless the oils have a wide boiling range. The acidity of oils in use approaches a constant value which differs under varying conditions of service. A considerable portion of the acidity is volatile with the diluent and the quantity can be controlled by engine accessories. The iodine numbers of oils decrease slightly in service but oils of high iodine numbers show no greater decrease than oils of low iodine numbers.

"Oil volatility and viscosity at the time of service are the only characteristics which bear a relation to changes in service."

In discussion the author recommended the necessity of removing the foreign content in the used lubricant before its characteristics are compared with a new oil. He stated that in his experience it is difficult to remove dilution below 5 per cent. He also recommended an oil change only four times per year.

In conclusion the author said that, "A review of the above material shows quite definitely that changes in characteristics of crankcase oils during service are dependent far more on the type of engine, its condition, and its manner of operation than upon the characteristics of the new oils as determined at present in the laboratory. The volatility of the oil, as measured by the spread in the distillation range and the viscosity in so far as it is affected by dilution at the time of service are the only characteristics which appear to have some quantitative relationship to the changes which the oils undergo."

"Oil Consumption in Motor Car Engines" by W. H. Graves, Chief Metallurgist of Packard Motor Car Co., gave the results of some important test work of *recent* origin. The author concludes that factors of engine design are of greater importance than the characteristics of the oil. In his opinion this is proved by the fact that there is such wide variation in oil consumption under different operating conditions. For example, recent tests show that oil consumption may increase from two to 20 times by doubling the engine speed. The important conclusions drawn are: 1. "That engine speed is one of the two most important variables affecting oil consumption and that doubling the speed may increase oil consumption from 2 to 20 times depending upon the engine design. 2. That engine design is the second of the two most important variables affecting oil consumption and that small changes in design affect oil consumption greatly. Piston and piston rings are details of design having the greatest effect. 3. That viscosity and volatility are the two important properties of oil that affect oil consumption. Oil consumption decreases with increased viscosity to a certain limit and then increases. Oil consumption increases with volatile oils only to a slight extent and is unimportant by comparison with other factors."

The volatility of an oil is shown to affect oil consumption and with the exception of viscosity, probably is more closely associated with oil consumption than any other property of the oil. Data are given showing that high volatility may double oil consumption but definite conclusions are not given because of insufficient test data. Incidentally, the author should like to see volatility defined in terms of engine temperature at the cylinder wall.

J. F. Stewart of Socony-Vacuum sprang a surprise in discussing this paper by showing the results of some new work now in progress at the Paulsboro laboratory. He shows that whereas engine conditions or design has a vital bearing on oil consumption, that it is also possible to show startling differences simply by varying the composition of certain lubricating oils.

A. Ludlow Clayden of the Sun Oil Co. presented an interesting thesis in "Factors in Engine Design Which Affect Oil Performance." In this paper he considers oil as an essential part of an engine and, as such, an element of extremely poor durability. He shows that the durability of engines as complete units would be improved by reducing the fatigue stresses on oil. A variety of possible modifications in mechanical design might accomplish this end, and, at any rate, methods for reducing oil wastage would assist in lessening fatigue stresses. He feels that there are many minor changes which could easily be made so as to improve the durability of oil and thereby the durability of the engine.

According to the author, one of the chief causes for heavy oil consumption is the fact that the cylinder wall gets much more lubricant than it requires. In actual practice, the volume supplied per revolution increases as the speed is increased. Not only because the delivery of the gear pump increases more rapidly than does the speed, but also because the bearings operate as centrifugal pumps and in most cases efficiency rises more rapidly than speed; in addition, when connecting rod bearings are supplied by passages drilled through the crank webs, the shaft becomes a centrifugal pump. Finally, the author questioned the present practice of maintaining a constant pressure on the oil supply by means of a spring loaded release valve. He believes that since the rotation of the shaft acts as a pump, the gage pressure on the supply could be reduced as speed increases without in any way starving the bearings.

The final paper on the program was "Aircraft Engine Lubrication," by Arthur Nutt. Much in keeping with the trend of the other papers, the author advocates the selection of lubricating oils on the basis of operating conditions and final tests in service rather than depend upon specifications. Among the requirements for an acceptable aircraft engine lubricant he mentions the need for a flat viscosity curve in combination with a low pour test. From his experience the author concludes that mineral oils are better than vegetable oils despite the fact that vegetable oils have been used to a great extent in Europe.

It was certainly interesting to learn that aircraft engine designers have found a way to build engines which hold oil consumption within the range of 0.10 to 0.020 lb. per brake horsepower hour.

A wrench and

Your Hands, a Few Moments' Time and These Tools are All it Takes
to completely adjust Stewart-Warner Automatic "Full Power" Brakes.
No brake-testing machine required.

STEWART-WARNER

a screw driver

That's All it Takes to Adjust Stewart-Warner Automatic *"Full Power"* Brakes

The Stewart-Warner Brake exhibit was a big center of attraction at the Auto Shows. Manufacturers who are interested in enthusing their dealers should have seen them gather around the booth. These brakes certainly registered with dealers as something absolutely different—something that would help them *sell* cars.

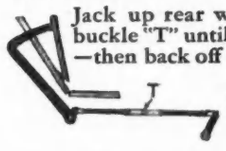
It was the *only* braking system worked by an outstanding new feature — the new Stewart-Warner Brake Pedal, no higher than a foot accelerator.

Here was something that *showed* at a glance the *important* difference between Stewart-Warner Automatic "Full Power" brakes and "partial power" brakes. They knew one demonstration to a prospect would convince him beyond a shadow of doubt of the quicker action and more accurate control of these "*Full* Power" Brakes. The simple adjustment was just one of the many features that appealed to these dealers.

Investigate the many economic, safety and *sales* advantages Stewart-Warner Automatic "Full Power" Brakes offer. Designed for factory installation on motor cars, motor coaches and trucks. Our engineers are at your command. Stewart-Warner Corporation, Brake Division, Chicago, U. S. A., or 6050 Cass Avenue, Detroit, Michigan.

Here's all it takes to adjust these brakes. No brake tester required

Complete Power Unit Linkage Adjustment



Jack up rear wheels. Tighten turnbuckle "T" until there is a slight drag —then back off one half turn past free position. Tool required—3/8" open end wrench.

Complete Wheel Brake Adjustment

Jack up wheels. Tighten adjusting nut "A" until wheel can just be turned by hand. Then back off the number of audible clicks given in car factory instructions. Should centralizing be necessary, simply tighten centralizer screw "C" until brake drags slightly. Back off until wheel is free. Tools required—1" open end wrench and screw driver.

Stewart-Warner Automatic "FULL POWER" Brakes Will Do More To Boost Car Sales Than Any Other Feature

Automatic
"FULL POWER" BRAKES

Let's LOOK BEHIND THE SCENE

Today's fine low-priced cars are the result of engineering skill carried into every tiny detail of construction. Take, for example, the Upson-made spare wheel support used on the sport models of a popular car.

To produce this part the engineering skill and the plant facilities of two Republic subsidiaries, Upson Nut Division and Steel and Tubes, Inc., were co-ordinated.

Five-eighth-inch stock was required to obtain the necessary metal in the flat section, but the threaded end could be only one-half-inch diameter. Swaging effected the reduction. The bar was next heated, flattened and bent in one operation, then clipped, punched and threaded.

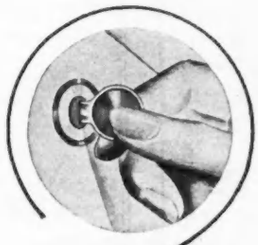
The same brains that worked out the manufacture of this part may be applied to your own particular problems when the quick, economical production of headed and threaded parts is required. Send us your inquiries.

UPSON

Bolts and nuts in all standard and special shapes, sizes, alloys and finishes. Standard and special rivets of all kinds. Wire rope clips. Turnbuckles. Belt fasteners. Automotive and railroad special items. Headed and threaded products for every use. Your specialties are our specialty.

UPSON NUT DIVISION
REPUBLIC STEEL
CORPORATION
CLEVELAND, OHIO

It is so easy, now



Just turn your ignition key "on" and Startix instantly, automatically starts the engine—repeats if the engine fails to continue running, and automatically re-starts it if the engine stalls.

Just as long as the ignition is "on," Startix is in automatic control of your engine without any thought or effort on your part.

STARTIX
The Automatic Starting Switch

Startix sets a new standard of safety, ease and convenience in starting.

Startix is a companion unit of the Bendix Drive—that dependable "mechanical hand that cranks your car." Standard on more than twenty million cars and trucks.

ECLIPSE MACHINE COMPANY, Elmira, N.Y.
BENDIX-ECLIPSE OF CANADA, LTD., Walkerville, Ont.
(Subsidiaries of Bendix Aviation Corporation)

THE BENDIX DRIVE
The Mechanical Hand That Cranks Your Car

BENDIX PRODUCTS

AUTOMOBILE · AVIATION · MARINE · INDUSTRIAL

P&J FOR OVER A QUARTER OF A CENTURY P&J
THE PIONEER MANUFACTURER OF AUTOMATIC CHUCKING EQUIPMENT
POTTER & JOHNSTON MACH. CO.
PAWTUCKET, R. I., U. S. A.

EXPANSION PLUGS
FOR CLOSING CORE HOLES
COILED and FLAT SPRINGS
PHOSPHOR BRONZE SPRINGS A SPECIALTY
SMALL STAMPINGS
WASHERS and SPRING COTTERS
WIRE SHAPES
M. D. HUBBARD SPRING CO.
620 SOUTH BLVD. PONTIAC, MICHIGAN

STAMPINGS
WORCESTER STAMPED METAL
Heavy, medium and light stampings in any quantity. A steady flow of production—*when* you want it.
WORCESTER STAMPED METAL CO. Worcester, Mass.

Pioneers in Better Drilling Methods
FOOTBURT
Single and multiple spindle special drilling, boring, reaming, tapping machine and FOOTBURT Sipp Sensitive Drilling Machines
THE FOOTE-BURT COMPANY CLEVELAND, OHIO

DEOXIDINE— Prepares Auto Bodies for Painting
RODINE— Pickle Bath Control
STRIPPLE High Speed Enamel Remover
PEROLINE— Rust Preventing Oil
KEMICK— Manifold Paint
FLOSOL— Soldering Flux
PARADOX— Rust Proofing Enamel
AMERICAN CHEMICAL PAINT CO.
AMBLER, PENNA.

CHAMBERSBURG-NATIONAL
COMPLETE FORGING EQUIPMENT
CHAMBERSBURG ENGINEERING CO. CHAMBERSBURG, PA.
THE NATIONAL MACHINERY CO. TIFFIN, OHIO
Sales Offices
NEW YORK, 152 W. 42nd St. CHICAGO, 565 W. Washington St.
DETROIT, 2457 Woodward Ave.

BUYERS' GUIDE

Automotive Products and Factory Equipment Manufactured by Advertisers in This Issue

See Alphabetical List of Advertisers on Page 40

This Advertiser's Index is published as a convenience, and not as part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

Alloys
Ferro
International Nickel Co.
Non-Ferrous
International Nickel Co.

Arms & Knuckles, Steering
Atlas Drop Forge Co.

Axles
Atlas Drop Forge Co.
Park Drop Forge Co.

Bearings, Anti-Friction
Ball
New Departure Mfg. Co.

Bearings, Journal Type
Plain
Bunting Brass & Bronze Co.

Bending & Straightening Machines
Chambersburg Engineering Co.
Chambersburg National Co.
National Machinery Co.

Blanks
Forged
Atlas Drop Forge Co.
Non-Ferrous
Bunting Brass & Bronze Co.

Boring Machines
Baker Bros., Inc.
Foote-Burt Co.

Brake Drums
Motor Wheel Corp.

Brakes
Mechanical
Stewart-Warner Corp.
Power
Bragg-Kliesrath Corp.
Stewart-Warner Corp.

Bumpers
Stewart-Warner Corp.

Bushings
Brass and Bronze
Bunting Brass & Bronze Co.
Fibre
Continental-Diamond Fibre Co.

Cable
Brake or Cut-Out Control
American Steel & Wire Co.
Ignition, Starting and Lighting
American Steel & Wire Co.

Camshafts
Atlas Drop Forge Co.

Castings, Brass and Bronze
Bunting Brass & Bronze Co.

Channels for Glass
Felt
American Felt Co.

Cleaners
Metal
American Chemical Paint Co. (Rust Preventive)

Clutches
Bragg-Kliesrath Corp.

Connecting Rods
Atlas Drop Forge Co.

Crankshafts
Atlas Drop Forge Co.
Park Drop Forge Co.

Cutters
Baker Bros., Inc. (Keyseating)
Fellows Gear Shaper Co. (Gear)

Dashes, Truck
Stolper Steel Products Co.

Drilling Machines
Baker Brothers, Inc.
Foote-Burt Co.
Greenlee Bros. & Co. (Multiple Spindle)

Enamels
American Chemical Paint Co. (Rust Proofing)

Engines
Waukesha Motor Co.

Felt
American Felt Co.

Fenders
Stolper Steel Products Co.

Fibre Rods, Sheets, Tubes
Continental-Diamond Fibre Co.

Forgings
Atlas Drop Forge Co.
Park Drop Forge Co.

Furnaces, Electric
(*Annealing, Carburizing, Heat Treating, Forging and Welding*)
Electric Furnace Co.

Gaskets
Felt
American Felt Co.

Gear Cutting Machines
Fellows Gear Shaper Co. (Shapers)

Gear Material
Non-Metallic
Continental-Diamond Fibre Co.

Gears
Timing, Non-Metallic
Continental-Diamond Fibre Co.

Grinding Machines
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Hammers
Power
Chambersburg Engineering Co.
Chambersburg National Co.
National Machinery Co.

Hangers
Shafting
New Departure Mfg. Co.

Heaters, Car
Stewart-Warner Corp.

Heat Treating
Barnes Co., Wallace
Barnes-Gibson-Raymond, Inc.
Gibson, Wm. D., Co.

Hoods
Stolper Steel Products Co.

ELECTRIC AND FUEL FIRED FURNACES
ELECTRIC FURNACE CO.
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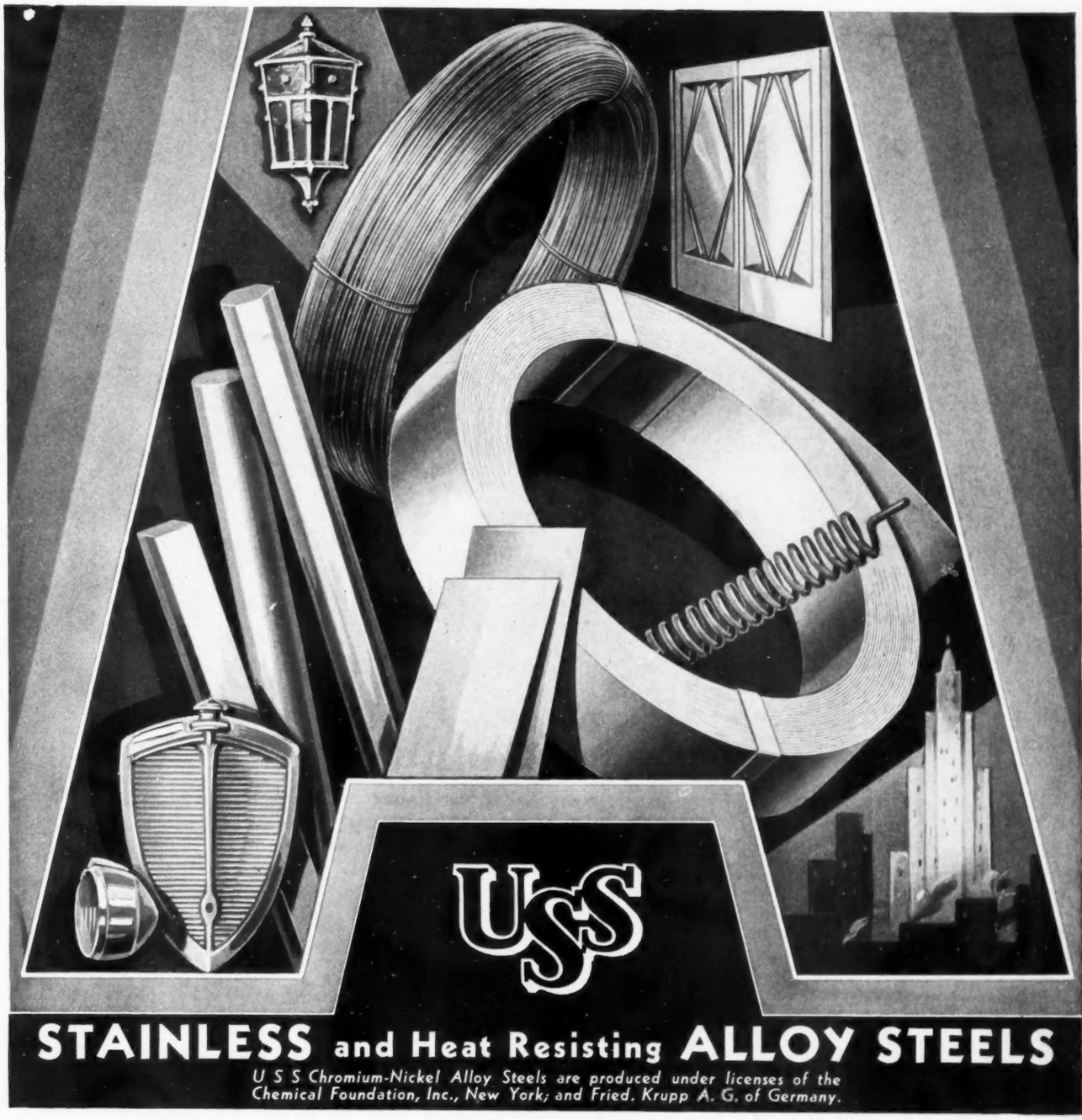

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